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Terminal 5
Preliminary Assessment Appendix I

Port of Portland

Terminal 5
Preliminary Assessment Appendix

Port of Portland

INDEX

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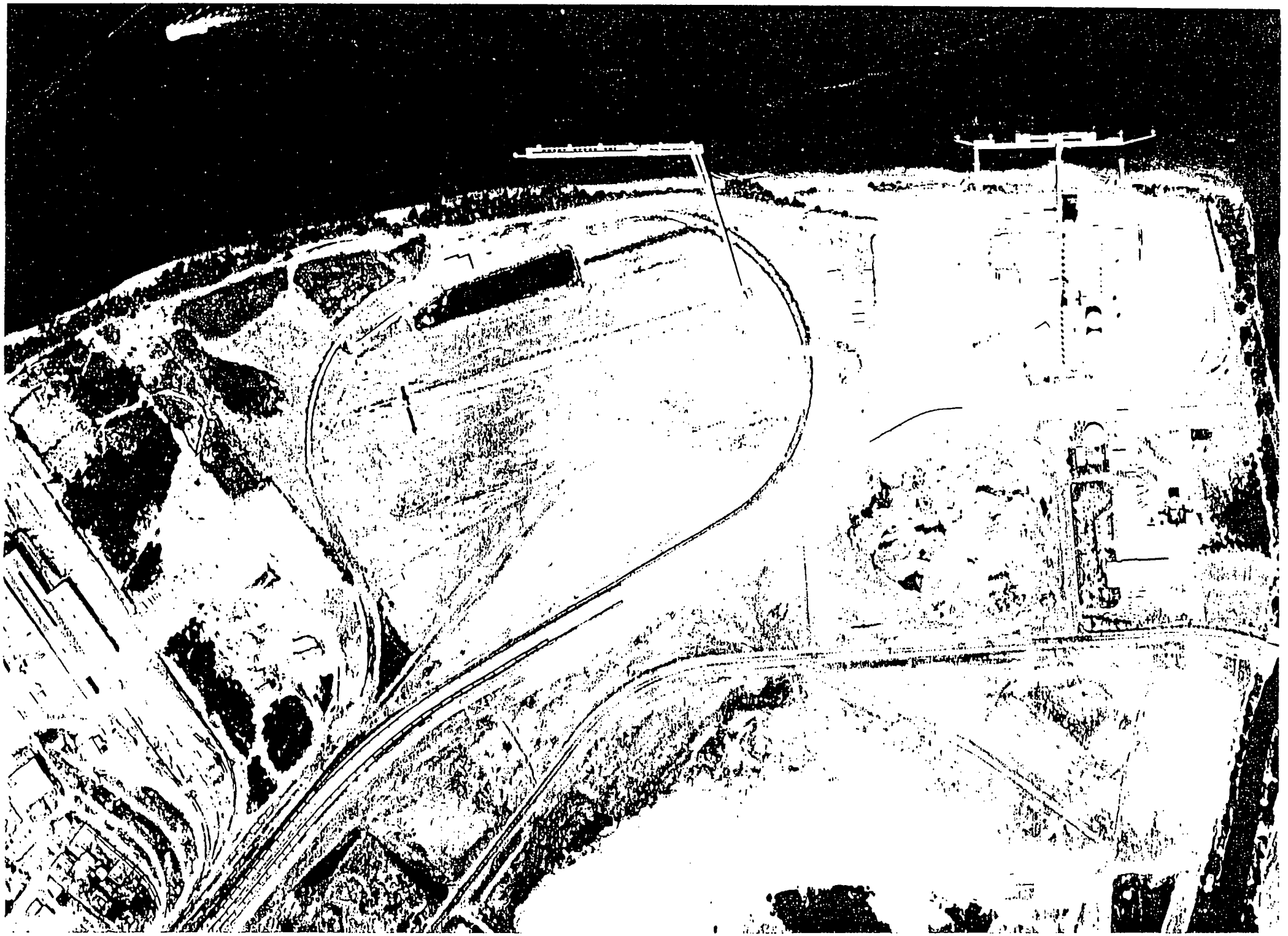
Attachment A
Stormwater System Map
Port of Portland Terminal 5

Attachment B
Aerial Photographs
Port of Portland Terminal 1



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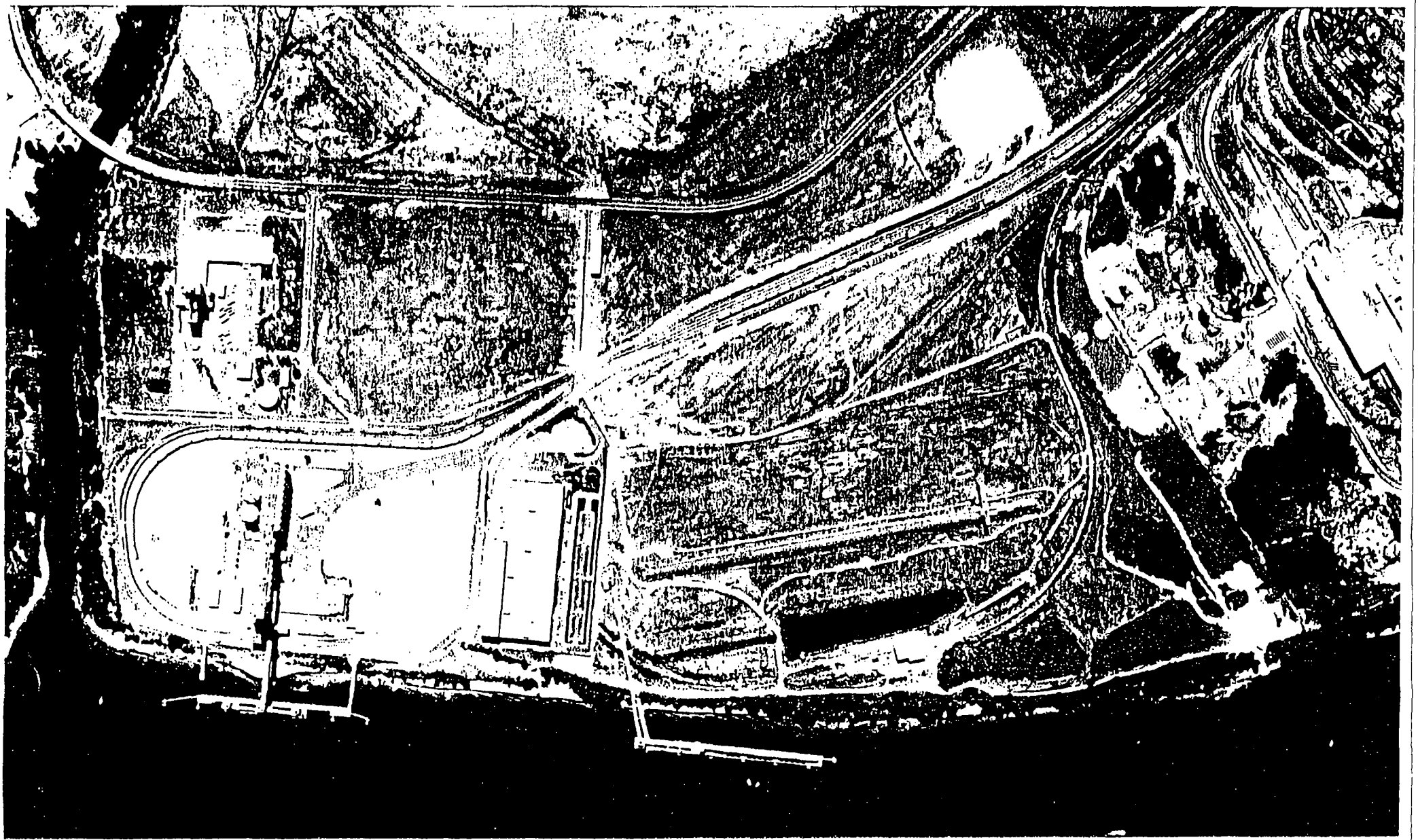


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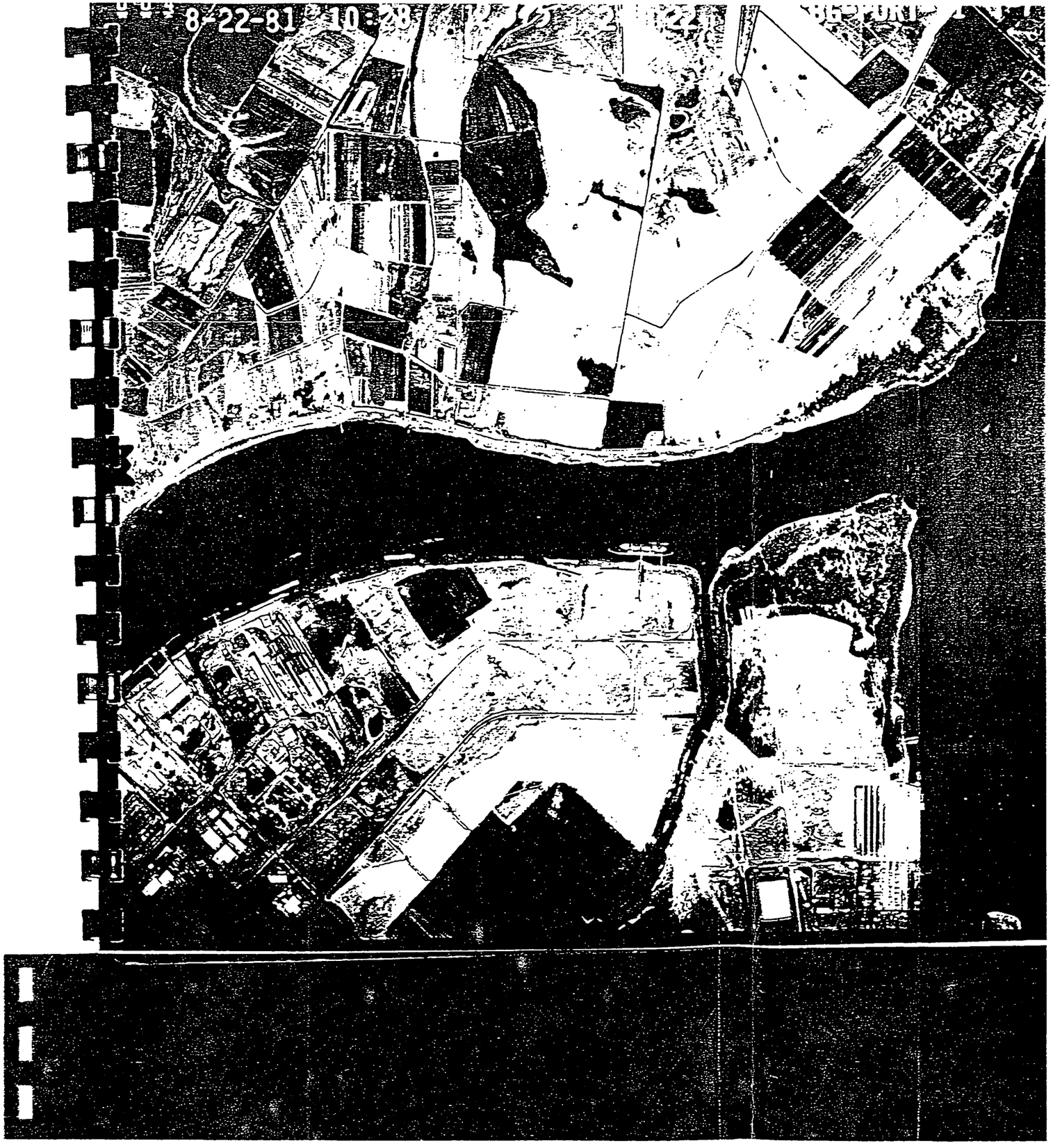
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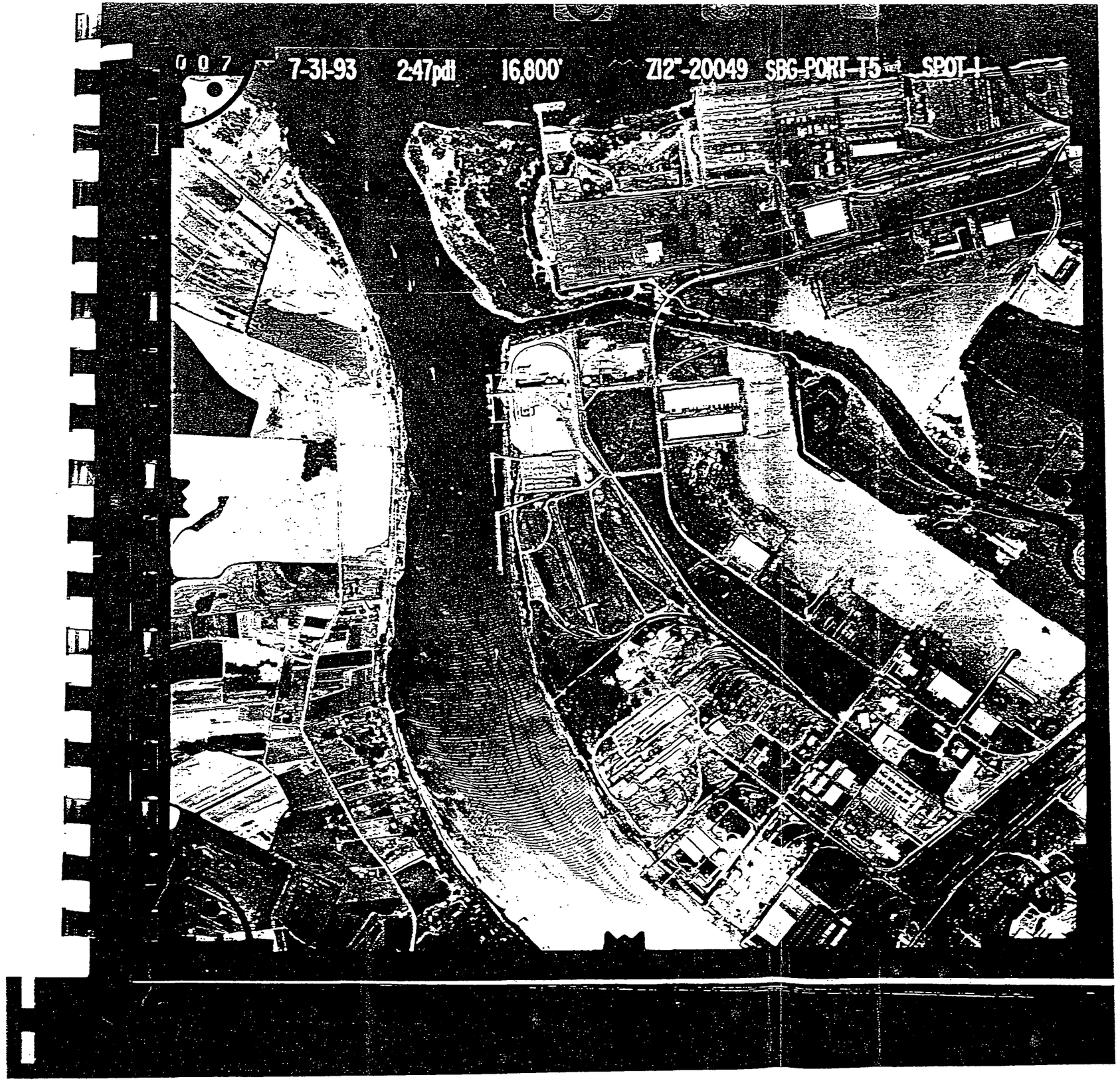
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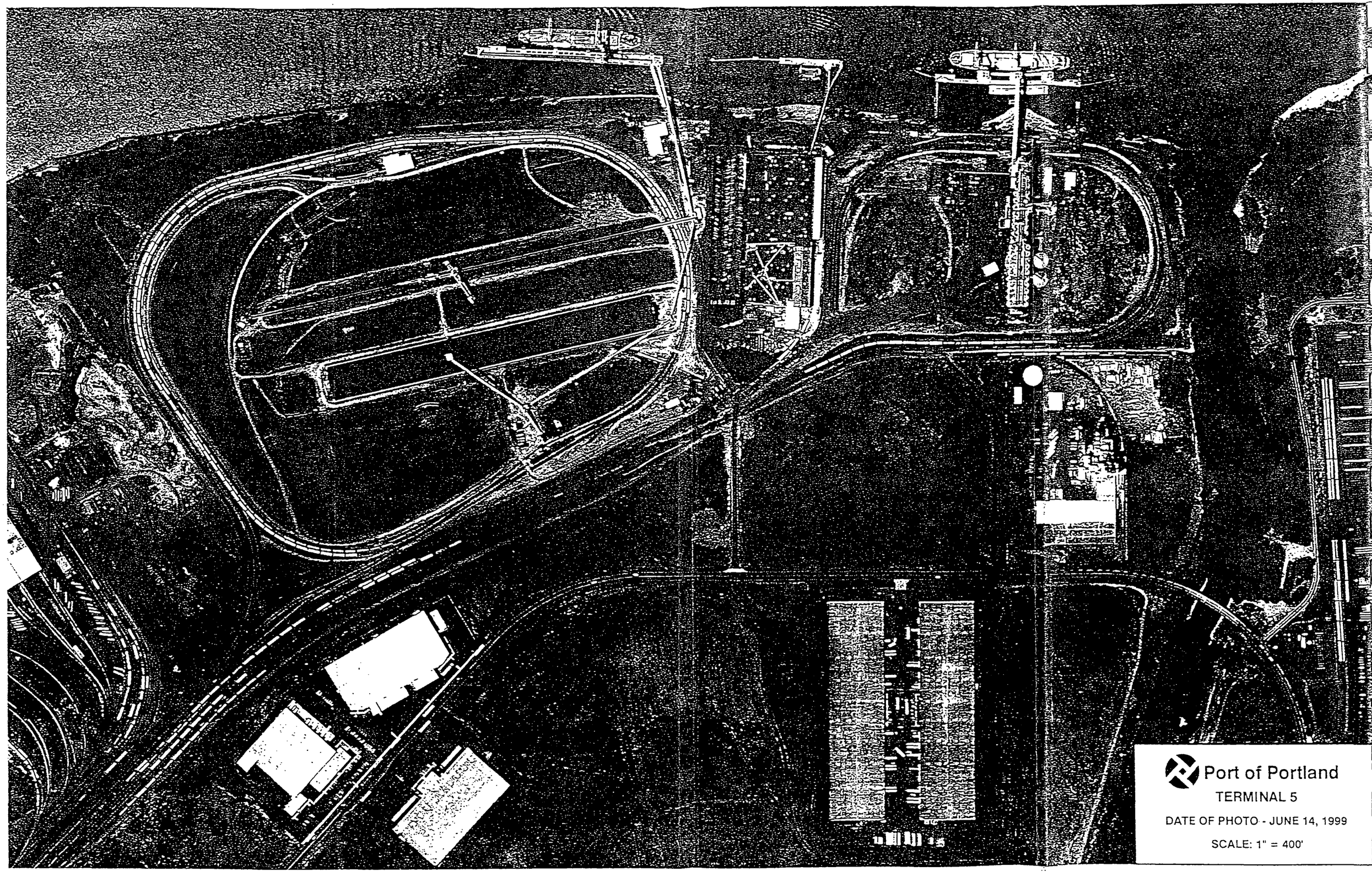

Port of Portland

TERMINAL 5

DATE OF PHOTO - JUNE 14, 1999

SCALE: 1" = 400'

Attachment C
Blue Lagoon Monitoring Results
Port of Portland Terminal 5

GROUNDWATER MONITORING REPORT

Port of Portland,
"Blue Lagoon" Site
Terminal 5
Portland, Oregon

December 22, 1999

Prepared for:

Port of Portland
Portland, Oregon

Port of Portland Project Task No. 51910-104

Prepared by:

Hahn and Associates, Inc.
Portland, Oregon

HAI Project # 4339

December 22, 1999

Mr. Pad Quinn
Port of Portland
PO Box 3529
Portland, Oregon 97208

Port Contract No. S2165
Port Project Task No. 51910-104
HAI Project No. 4339

SUBJECT: Groundwater Monitoring Report, October 1999 Sampling Event, "Blue Lagoon" Site, Terminal 5, Portland, Oregon

Dear Mr. Quinn:

1.0 Introduction

The Port of Portland retained Hahn and Associates, Inc. (HAI) to perform groundwater sampling of monitoring wells located at the "Blue Lagoon" site, Terminal 5 in Portland, Oregon (Figures 1 and 2). This report documents the groundwater sampling performed in October 1999. Groundwater samples were obtained from three remaining monitoring wells at the subject site and were analyzed for pH and the presence of selected metals.

2.0 Background

The "Blue Lagoon" site is located in the southern portion of the Port of Portland's Marine Terminal 5 property, approximately 1,500 feet east of the Willamette River. An area much larger than the "Blue Lagoon" feature shown in this report was a former surface water feature in the area. Over the years this feature was filled by Oregon Steel Mills with steel slag and other materials. In 1996, the Port of Portland completed the filling of the lagoon with placement of clean sand. Most of the area has been raised above the 100-year floodplain by the placement of dredged material.

From 1975 to 1994, Oregon Steel Mills, which borders the "Blue Lagoon" property to the south, used this area as a storage and disposal site for steel slag. Oregon Steel Mills also withdrew surface water from the lagoon for use as an industrial coolant, and returned the water to the lagoon via a drainage ditch. Oregon Steel Mills owned the "Blue Lagoon" property until the early 1980's.

The soil, slag, sediment, surface water, and groundwater of the "Blue Lagoon" site has been investigated by a number of parties over the years including Century West Engineering Corporation (1994) [1], PTI Environmental Services (1995) [2], and

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[1] Century West Engineering Corporation (1994), *Preliminary Site Assessment for the Blue Lagoon, Terminal 5*, February 4, 1994.

[2] PTI Environmental Services (1995), *Site Characterization for the "Blue Lagoon" at Marine Terminal 5*, April 1995.

GeoEngineers (1997) [3]. Four monitoring wells were installed at the site on October 20, 1993 by Century West. Since that time the monitoring wells have been sampled on seven occasions (October 1993, February 1995, April 1996, October 1998, April 1999, July 1999, and October 1999).

3.0 Field Activities

On October 19, 1999, groundwater samples were obtained from the three remaining monitoring wells (MW-2, MW-3, and MW-4) at the subject site (Figure 3). Monitoring well construction characteristics are summarized in Table 1.

Prior to sampling each monitoring well, three well volumes of water were purged from the well using a peristaltic pump at a low flow rate (less than 1 liter/minute) to minimize turbidity. The intake tubing was set immediately above the top of the well screen for purging. The pH, temperature and conductivity of the groundwater were measured during the purging process to monitor for stabilization of these parameters. Purge records are included in Appendix A. Following purging, a representative sample of the groundwater was then collected into the appropriately-preserved sampling containers using the peristaltic pump. Water samples collected and analyzed for dissolved metals were field-filtered with an in-line 0.45-micron filter. Water samples collected and analyzed for total metals were unfiltered. The sample bottles were then transferred to a chilled container for shipment to the analytical laboratory.

The static water levels in the three monitoring wells at the site were measured prior to initiating any purging activities on October 19, 1999 using a Solinst water level indicator (conductive probe). The water levels were measured from the north side of the top of each well's casing. Three rounds of water level measurements were collected from the monitoring wells to ensure that two consecutive water level measurements were within 0.01 feet. At the request of the Port of Portland, a water level measurement event was also conducted on September 21, 1999. The final water level measurements and groundwater elevations are summarized on Table 2.

Purge water from the monitoring wells was placed on the ground in the vicinity of the respective monitoring wells.

4.0 Analytical Testing

The groundwater samples were shipped accompanied by chain-of-custody documentation in a sealed and chilled container to Oregon Analytical Laboratory in Beaverton, Oregon. The unfiltered groundwater samples were analyzed for total metals (arsenic, barium, cadmium, chromium, copper, iron, lead, manganese, mercury, nickel, and zinc) by U.S. Environmental Protection Agency (EPA) Method 200 Series. For metals that were detected on a total basis at concentrations greater than EPA Maximum Contaminant Levels (MCLs), the respective filtered sample was also analyzed for the respective dissolved metals. As such, all 3 groundwater samples were analyzed for dissolved iron and

[3] GeoEngineers (1997), *Ground Water Monitoring, "Blue Lagoon" Site*, March 7, 1997.

manganese by EPA 200.7/6010 Methods. Each sample was also analyzed for pH by EPA Method 150.1, to compare to the field-measured pH value. Each sample was also analyzed for total alkalinity by Standard Method (SM) 2320B.

Analytical results for the October 1999 groundwater sampling event are summarized on Table 3. Historical groundwater sampling results are summarized on Table 4. Laboratory analytical reports and chain-of-custody documentation for the October 1999 groundwater samples are included in Appendix B.

5.0 Results and Discussion

Water level measurements obtained from the wells on October 19, 1999 ranged from 9.3 to 10.9 feet below top of casing at elevations of 29.46 to 30.46 feet above mean seal level (Table 2). A hydrograph showing seasonal fluctuations of water levels over time is included in Figure 4. Seasonal fluctuations up to 5 feet were observed over the past year, which are likely related to river stage levels. Groundwater flow direction was observed to be south-southwesterly on October 19, 1999 (Figure 5) which is similar to previous events conducted by HAI. It should be emphasized that the south-southwesterly groundwater flow direction may be very localized, being affected by the filling of the area, and not necessarily reflective of the area-wide groundwater flow.

Analytical results for monitoring wells MW-2, MW-3, and MW-4 indicate that total (unfiltered) arsenic, barium, iron, and manganese were detected in all three wells. Total nickel was detected in well MW-4 (Table 3). The total iron and manganese concentrations exceed EPA Secondary Maximum Contaminant Levels (MCLs) in all three groundwater samples.

The results of analytical testing of the filtered samples indicate that dissolved iron and manganese were also detected in the samples. The dissolved iron and manganese concentrations exceed EPA Secondary MCLs in all three groundwater samples.

The detection of iron and manganese at concentrations exceeding EPA secondary MCLs is not of particular concern since the MCLs for these metals are secondary standards relating to aesthetic quality of water as opposed to human health risk.

The results of laboratory-measured pH indicate a range of pH from 6.4 to 9.0. Total alkalinity was measured in the samples at concentrations ranging from 71 to 489 milligrams/liter.

6.0 Limitations

The samples discussed in this report were collected, analyzed, and interpreted following the standards of care, skill, and diligence ordinarily provided by a professional in the performance of similar services as of the time the services were performed. This report and the conclusions and/or recommendations contained in it are based solely upon physical sampling and analytical activities that were conducted at the Client's request. The data presented in this report document only the concentrations of the target analytes in the particular sample and not the property as a whole.

Any questions regarding the information presented in this report are welcome and should be referred to the undersigned or Mr. Roger Brown of HAI. Thank you for the opportunity to be of service to The Port of Portland.

Respectfully,

Jason M. Greifer
Environmental Scientist

attachments

TABLE 1 - Monitoring Well Construction Summary

Groundwater Monitoring
"Blue Lagoon" Site
Port of Portland, Terminal 5
Portland, Oregon

Project #4339

Well Number	Date Installed	Installation Method	Monument Type	Screen Type	Slot Size (inches)	Sand Pack (Silica Sand)	Well Diameter (inches)	Ground Surface[1] (feet msl)	Top of Casing[2] (feet msl)	Boring Depth (feet bgs)[3]	Top Screen (feet bgs)[3]	Base Screen (feet bgs)[3]
MW-1[4]	20-Oct-93	Hollow Stem Auger	Above-Grade	Slotted PVC	0.020	#8	2	-	38.76	20.0	3.0	19.5
MW-2	20-Oct-93	Hollow Stem Auger	Above-Grade	Slotted PVC	0.020	#8	2	34.8	38.35	21.5	3.0	19.5
MW-3	20-Oct-93	Hollow Stem Auger	Above-Grade	Slotted PVC	0.020	#8	2	36.9	39.91	22.5	3.0	18.0
MW-4	20-Oct-93	Hollow Stem Auger	Above-Grade	Slotted PVC	0.020	#8	2	37.3	39.05	22.5	4.5	19.5

Note: bgs = below ground surface msl = mean sea level PVC = polyvinyl chloride

1 = Ground surface elevation as of October 2, 1998
2 = Based on October 2, 1998 survey by Chase Jones & Associates, Inc.
3 = Depth based on ground surface at time of installation, which is different than current ground surface; exact difference is not known
4 = MW-1 was abandoned during railroad spur construction; date unknown

TABLE 2 - Summary of Water Level Measurements and Groundwater Elevations

Groundwater Monitoring
"Blue Lagoon" Site
Port of Portland, Terminal 5
Portland, Oregon

Project #4339

Elevation of Top of Casing

Date Surveyed	Surveyed By	Elevation of Top of Casing (feet msl)[1]			
		MW-1	MW-2	MW-3	MW-4
Nov-93	Century West	34.78	34.26	34.22	34.42
Oct-98	Chase Jones	40.03[2]	39.63	41.17	40.32

Measured Water Level

Date Measured	Measured By	Measured Water Level (feet btc)			
		MW-1	MW-2	MW-3	MW-4
22-Oct-93	Century West	7.77	7.27	6.81	8.54
16-Nov-93	Century West	8.24	7.67	7.21	9.02
27-Feb-95	PTI	1.69	1.12	0.96	2.50
2-Mar-95	PTI	1.71	1.16	1.00	1.80
24-Apr-96	GeoEngineers	2.14	1.56	1.46	1.68
Well Monuments Converted to Above-Grade					
1-Nov-96	GeoEngineers	8.29	7.82	9.06	8.09
2-Oct-98	HAI	Abandoned	9.02	10.32	10.57
13-Apr-99	HAI	-	5.28	6.81	6.18
29-Jul-99	HAI	-	7.61	9.02	8.64
21-Sep-99	HAI	-	8.83	10.16	10.41
19-Oct-99	HAI	-	9.31	10.71	10.86

Groundwater Elevation

Date Measured	Measured By	Groundwater Elevation (feet msl)[1]			
		MW-1	MW-2	MW-3	MW-4
22-Oct-93	Century West	27.01	26.99	27.41	25.88
16-Nov-93	Century West	26.54	26.59	27.01	25.40
27-Feb-95	PTI	33.09	33.14	33.26	31.92
2-Mar-95	PTI	33.07	33.10	33.22	32.62
24-Apr-96	GeoEngineers	32.64	32.70	32.76	32.74
1-Nov-96	GeoEngineers	31.74	31.81	32.11	32.23
2-Oct-98	HAI	-	30.61	30.85	29.75
13-Apr-99	HAI	-	34.35	34.36	34.14
29-Jul-99	HAI	-	32.02	32.15	31.68
21-Sep-99	HAI	-	30.80	31.01	29.91
19-Oct-99	HAI	-	30.32	30.46	29.46

NOTE: btc = below top of casing msl = mean sea level

1 = City of Portland datum

2 = Elevation estimated based on difference between GeoEngineers and Chase Jones surveys

TABLE 3 - Summary of Analytical Results for Groundwater Samples - October 1999 Sampling Event

"Blue Lagoon" Site
Port of Portland, Terminal 5
Portland, Oregon

Project #4339

Well Number	Sample Number	Sample Date	Analytical Results in mg/l (ppm)												
			pH by EPA 150.1	Total Alkalinity by SM 2320B	Total and Dissolved Metals by EPA Method 200 Series										
					Arsenic	Barium	Cadmium	Chromium	Copper	Iron	Lead	Manganese	Mercury	Nickel	Zinc
Total (Unfiltered) Metals															
MW-2	4339-991019-001	19-Oct-99	9.0	94.	0.012	0.0236	ND>0.002	ND>0.005	ND>0.002	1.88	ND>0.001	0.235	ND>0.0002	ND>0.010	ND>0.010
MW-3	4339-991019-002	19-Oct-99	6.4	71.	0.0036	0.0105	ND>0.002	ND>0.005	ND>0.002	3.4	ND>0.001	0.572	ND>0.0002	ND>0.010	ND>0.010
MW-4	4339-991019-003	19-Oct-99	6.5	489.	0.0348	0.0896	ND>0.002	ND>0.005	ND>0.002	71.8	ND>0.001	7.4	ND>0.0004	0.01	ND>0.010
Dissolved (Filtered) Metals															
MW-2	4339-991019-001	19-Oct-99	-	-	-	-	-	-	-	1.11	-	0.197	-	-	-
MW-3	4339-991019-002	19-Oct-99	-	-	-	-	-	-	-	3.36	-	0.580	-	-	-
MW-4	4339-991019-003	19-Oct-99	-	-	-	-	-	-	-	72.1	-	7.29	-	-	-
EPA MCLs -->			6.5 - 8.5	#	0.05	2.	0.005	0.1	1.	0.3	0.015	0.05	0.002	0.1	5.

Note. # = not established
EPA = U.S. Environmental Protection Agency
MCL = Maximum Contaminant Level

mg/l = milligrams/liter
ND = not detected above detection limit indicated
ppm = parts per million

Bold and shaded = Detected concentration exceeds EPA MCL

Updated: 12/6/99 JMG
File Name: 4339-03,04 Metals Rslts

HAHN AND ASSOCIATES, INC..

TABLE 4 – Summary of Historical Analytical Results for Groundwater Monitoring Samples
Total and Dissolved Metals, pH

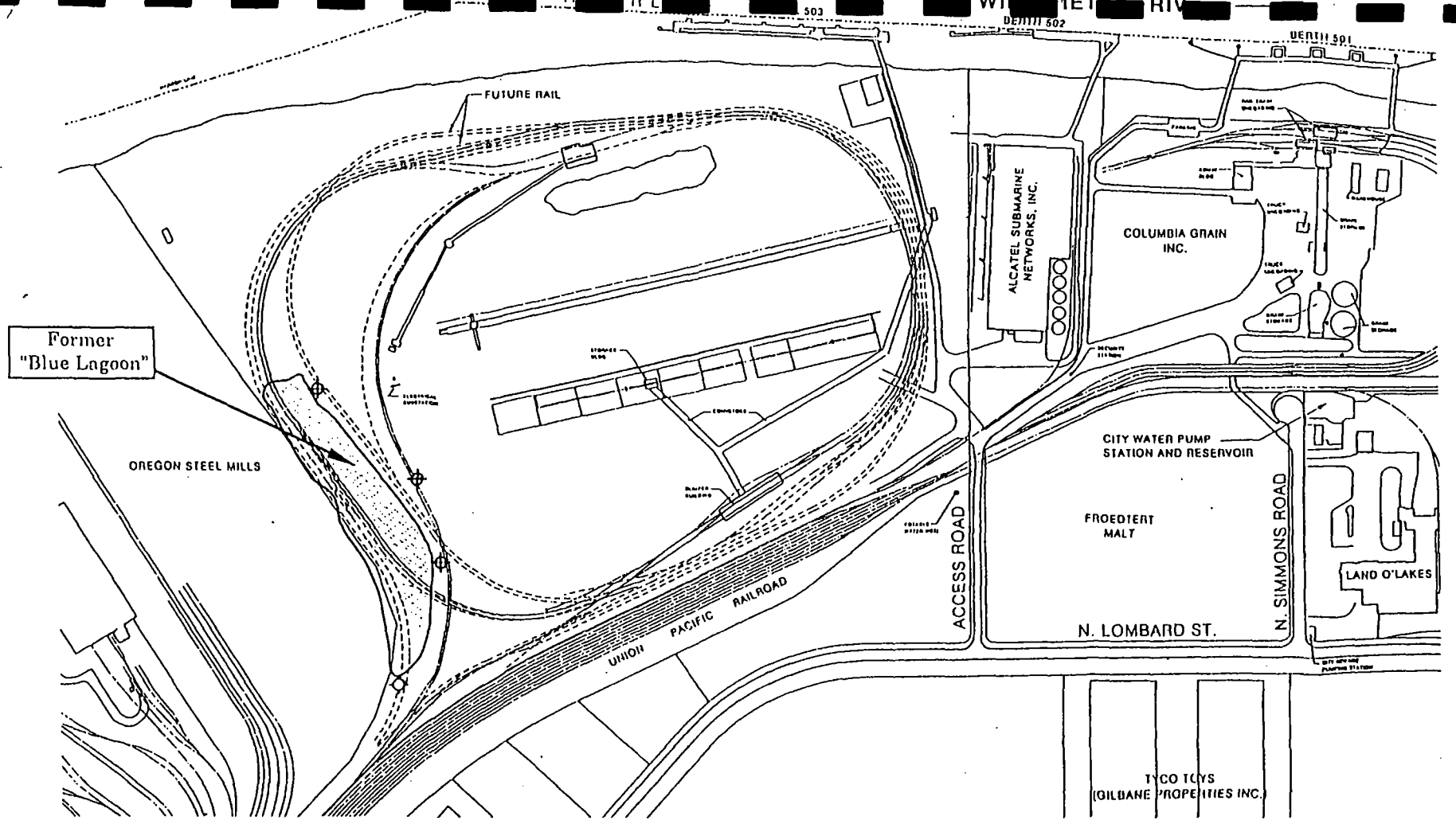
"Blue Lagoon" Site
Port of Portland, Terminal 5
Portland, Oregon

Well Number	Sample Date	Sampled By	Analytical Results mg/l (ppm)															
			pH	Total Alkalinity	Antimony	Arsenic	Barium	Cadmium	Chromium	Copper	Iron	Lead	Manganese	Mercury	Nickel	Silver	Zinc
Total (Unfiltered) Metals																		
MW-1	22-Oct-93	Century West	-	-	ND[7]	0.068	0.558	ND[3]	0.274	0.112	-	0.048		0.0002	0.0064	ND[3]	0.238
	27-Feb-95	PTI	-	-	ND[7]	ND[3]	0.727	ND[3]	0.15	0.0095	-	ND[4]	-	ND[3]	ND[4]	ND[3]	0.0056
	24-Apr-96	GeoEngineers	11.04	-	ND[3]	0.009	0.66	ND[4]	0.2	0.02	-	0.019	-	ND[3]	ND[7]	ND[3]	0.83
MW-2	22-Oct-93	Century West	-	-	ND[7]	0.091	2.03	ND[3]	0.134	0.214	-	0.12	-	0.0012	0.188	ND[3]	0.868
	27-Feb-95	PTI	-	-	ND[7]	ND[3]	0.101	ND[3]	ND[4]	0.002	-	ND[4]	-	ND[3]	ND[4]	ND[3]	0.0
	24-Apr-96	GeoEngineers	6.15	-	ND[3]	0.019	1.69	ND[4]	0.16	0.2	-	0.06	-	0.0008	0.127	ND[3]	0.83
	2-Oct-98	HAI	6.75	-	-	0.0099	0.0641	ND[3]	ND[3]	ND[3]	16.5	ND[3]	0.924	ND[3]	ND[3]	ND[3]	ND[3]
	13-Apr-99	HAI	9.91	-	-	0.0086	0.0313	ND[3]	ND[3]	0.0021	2.37	ND[3]	0.293	ND[3]	ND[3]	ND[3]	ND[3]
	29-Jul-99	HAI	9.58	87.	-	0.0133	0.0145	ND[3]	ND[3]	0.0021	0.85	ND[3]	0.097	ND[3]	ND[3]	ND[3]	ND[3]
	19-Oct-99	HAI	9.0	94.	-	0.012	0.0236	ND[3]	ND[4]	ND[3]	1.88	ND[3]	0.235	ND[3]	ND[4]	ND[3]	ND[4]
MW-3	22-Oct-93	Century West	-	-	ND[7]	ND[3]	0.234	ND[3]	0.0394	0.0459	-	ND[4]	-	ND[3]	0.042	ND[3]	0.174
	27-Feb-95	PTI	-	-	ND[7]	ND[3]	0.0079	ND[3]	ND[4]	ND[3]	-	ND[4]	-	ND[3]	ND[4]	ND[3]	0.0
	24-Apr-96	GeoEngineers	7.00	-	ND[3]	0.008	0.12	ND[4]	0.01	0.02	-	0.007	-	ND[3]	ND[7]	ND[3]	0.01
	2-Oct-98	HAI	6.65	-	-	0.004	0.0091	ND[3]	ND[3]	ND[3]	3.06	ND[3]	0.506	ND[3]	0.0036	ND[3]	ND[3]
	13-Apr-99	HAI	7.02	-	-	0.002	0.0185	ND[3]	ND[3]	ND[3]	5.	ND[3]	0.608	ND[3]	ND[3]	ND[3]	ND[3]
	29-Jul-99	HAI	6.67	71.	-	0.0049	0.0132	ND[3]	ND[3]	ND[3]	6.95	ND[3]	0.57	ND[3]	ND[3]	ND[3]	ND[3]
	19-Oct-99	HAI	6.4	71.	-	0.0036	0.0105	ND[3]	ND[4]	ND[3]	3.4	ND[3]	0.572	ND[3]	ND[4]	ND[3]	ND[4]
MW-4	22-Oct-93	Century West	-	-	ND[7]	0.092	0.949	0.0023	0.135	0.217	-	0.115	-	0.0011	0.163	ND[4]	0.646
	27-Feb-95	PTI	-	-	ND[7]	ND[3]	0.0513	ND[3]	0.006	0.0063	-	ND[4]	-	ND[3]	ND[3]	ND[4]	ND[3]
	24-Apr-96	GeoEngineers	6.00	-	ND[3]	ND[3]	0.09	ND[4]	0.01	0.02	-	0.006	-	ND[3]	ND[7]	ND[4]	0.06
	2-Oct-98	HAI	6.56	-	-	0.0104	0.0898	ND[3]	ND[3]	ND[3]	41.6	ND[3]	7.85	ND[3]	0.0115	-	0.0077
	13-Apr-99	HAI	6.71	-	-	ND[3]	0.0133	ND[3]	ND[3]	ND[3]	1.63	ND[3]	0.084	ND[3]	0.002	-	ND[4]
	29-Jul-99	HAI	6.30	215.	-	0.0037	0.0405	ND[3]	ND[3]	ND[3]	7.97	ND[3]	1.19	ND[3]	0.0072	-	ND[4]
	19-Oct-99	HAI	6.5	489.	-	0.0348	0.0896	ND[3]	ND[4]	ND[3]	71.8	ND[3]	7.4	ND>0.0004	0.01	-	ND[4]
Dissolved (Filtered) Metals																		
MW-1	22-Oct-93	Century West	-	-	ND[7]	ND[3]	0.0295	ND[3]	ND[4]	ND[3]	-	ND[4]	-	ND[3]	0.011	ND[4]	ND[4]
	27-Feb-95	PTI	-	-	ND[7]	ND[3]	0.566	ND[3]	0.107	ND[3]	-	ND[4]	-	ND[3]	ND[4]	ND[4]	ND[4]
	24-Apr-96	GeoEngineers	-	-	ND[3]	ND[4]	0.61	ND[3]	0.18	ND[4]	-	0.004	-	ND[3]	ND[7]	ND[4]	0.02
MW-2	22-Oct-93	Century West	-	-	ND[7]	0.057	0.18	ND[3]	ND[4]	ND[3]	-	ND[4]	-	ND[3]	ND[4]	ND[4]	0.0096
	27-Feb-95	PTI	-	-	ND[7]	ND[3]	0.594	ND[3]	ND[4]	ND[3]	-	ND[4]	-	ND[3]	ND[4]	ND[4]	ND[4]
	24-Apr-96	GeoEngineers	-	-	ND[3]	0.007	0.13	ND[4]	ND[4]	ND[4]	-	ND[3]	-	ND[3]	ND[7]	ND[4]	ND[4]
	2-Oct-98	HAI	-	-	-	0.0082	-	-	-	-	17.2	-	0.983	-	-	-	-
	13-Apr-99	HAI	-	-	-	-	-	-	-	-	0.672	-	0.209	-	-	-	-
	29-Jul-99	HAI	-	-	-	-	-	-	-	-	0.165	-	0.068	-	-	-	-
	19-Oct-99	HAI	-	-	-	-	-	-	-	-	1.11	-	0.197	-	-	-	-
MW-3	22-Oct-93	Century West	-	-	ND[7]	ND[3]	0.0091	ND[3]	ND[4]	ND[3]	-	ND[3]	-	ND[3]	ND[4]	ND[4]	ND[4]
	27-Feb-95	PTI	-	-	ND[7]	ND[3]	0.004	ND[3]	ND[4]	ND[3]	-	ND[4]	-	ND[3]	ND[4]	ND[4]	0.0132
	24-Apr-96	GeoEngineers	-	-	ND[3]	ND[4]	ND[4]	ND[3]	ND[4]	ND[4]	-	ND[3]	-	ND[3]	ND[7]	ND[4]	ND[4]
	2-Oct-98	HAI	-	-	-	0.0022	-	-	-	-	2.	-	0.493	-	-	-	-
	13-Apr-99	HAI	-	-	-	-	-	-	-	-	4.94	-	0.592	-	-	-	-
	29-Jul-99	HAI	-	-	-	-	-	-	-	-	4.82	-	0.595	-	-	-	-
	19-Oct-99	HAI	-	-	-	-	-	-	-	-	3.35	-	0.586	-	-	-	-
MW-4	22-Oct-93	Century West	-	-	ND[7]	0.075	0.126	ND[3]	ND[4]	ND[3]	-	ND[4]	-	ND[3]	ND[4]	ND[4]	ND[4]
	27-Feb-95	PTI	-	-	ND[7]	ND[3]	0.0192	ND[3]	ND[4]	ND[3]	-	ND[4]	-	ND[3]	ND[4]	ND[4]	0.019
	24-Apr-96	GeoEngineers	-	-	ND[3]	ND[4]	0.02	ND[4]	ND[4]	ND>.02	-	ND[3]	-	ND[3]	ND[7]	ND[4]	0.01
	2-Oct-98	HAI	-	-	-	0.0107	-	-	-	-	45.	-	8.05	-	-	-	-
	13-Apr-99	HAI	-	-	-	-	-	-	-	-	0.198	-	0.077	-	-	-	-
	29-Jul-99	HAI	-	-	-	-	-	-	-	-	17.8	-	3.	-	-	-	-
	19-Oct-99	HAI	-	-	-	-	-	-	-	-	72.1	-	7.29	-	-	-	-
		EPA MCLs -->	6.5 - 8.5	#	0.006	0.05	2.	0.005	0.1	1.	0.3	0.015	0.05	0.002	0.1	0.1	5.

Note:
= not established
- = not analyzed
EPA = U.S. Environmental Protection Agency
MCL = Maximum Contaminant Level

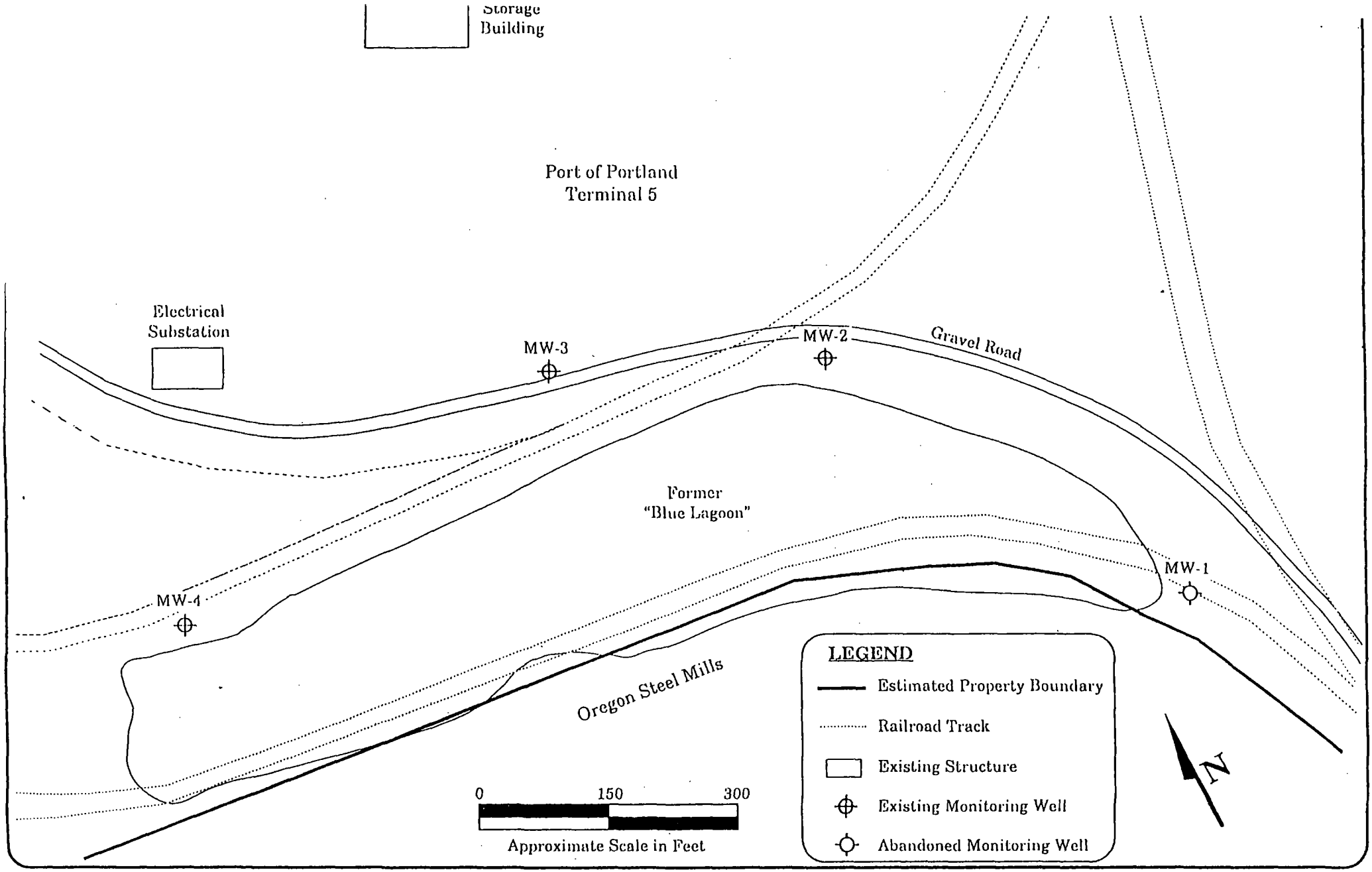
mg/l = milligrams/liter
ND = not detected above detection limit indicated
ppm = parts per million
Bold and shaded = Detected concentration exceeds reference level

1 = Detection Limit is 0.0002 mg/l
2 = Detection Limit is 0.001 mg/l
3 = Detection Limit is 0.002 mg/l
4 = Detection Limit is 0.003 mg/l
5 = Detection Limit is 0.005 mg/l
6 = Detection Limit is 0.010 mg/l
7 = Detection Limit is 0.020 mg/l
8 = Detection Limit is 0.025 mg/l
9 = Detection Limit is 0.050 mg/l

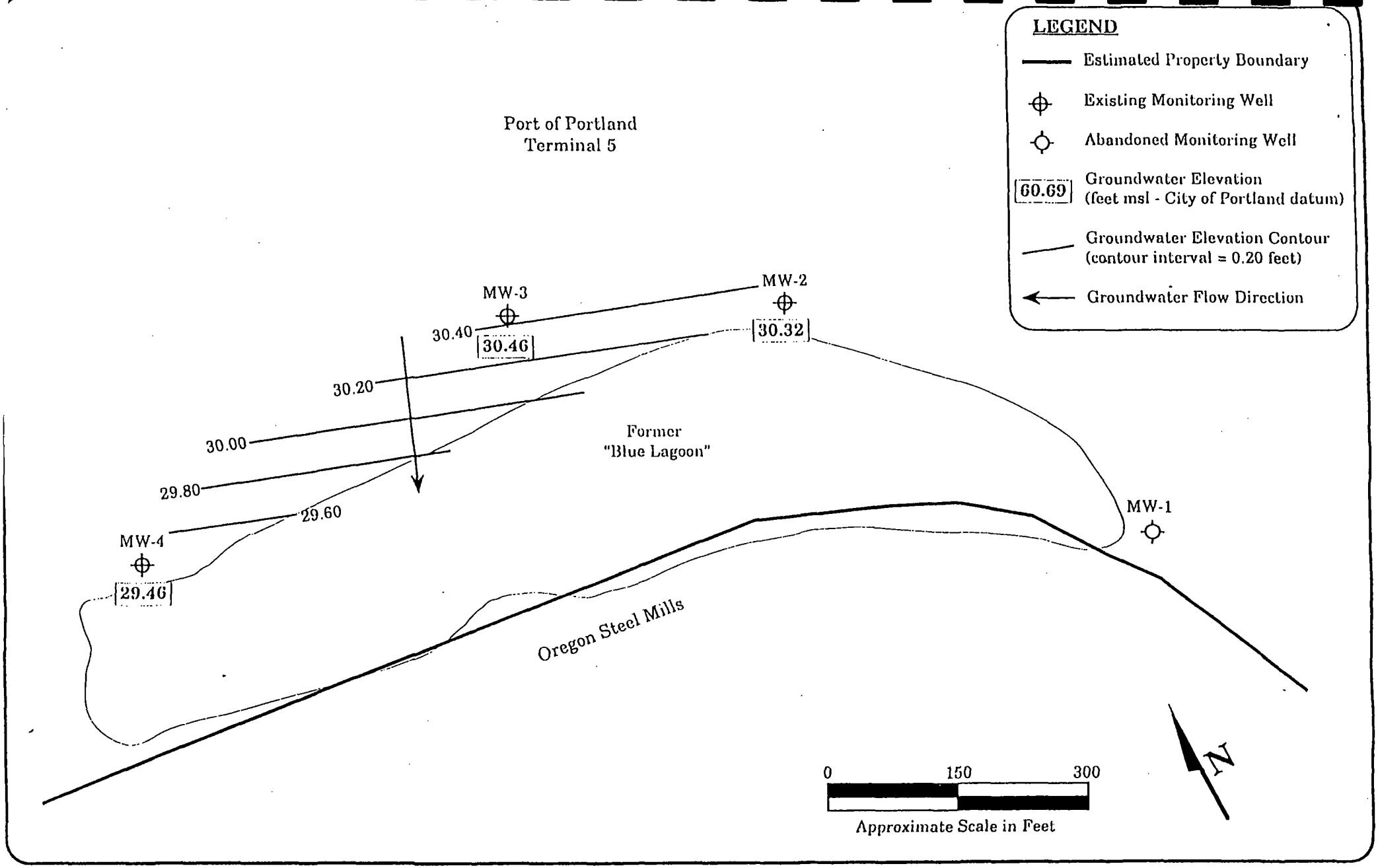


Source: Base from Port of Portland Map, April 1997

HAI Project No. 4339	**HAHN AND ASSOCIATES** INCORPORATED	**Site Map**	FIGURE
October 1999	ENVIRONMENTAL MANAGEMENT 434 NW SIXTH AVENUE, SUITE 203 PORTLAND, OREGON 97209 (503) 796-0717	Port of Portland, "Blue Lagoon" Site Terminal 5 Portland, Oregon	2



HAI Project No. 4339 October 1999	**HAHN AND ASSOCIATES** INCORPORATED ENVIRONMENTAL MANAGEMENT 434 NW SIXTH AVENUE, SUITE 203 PORTLAND, OREGON 97209 (503) 796-0717	**Monitoring Well Location Map** Port of Portland, "Blue Lagoon" Site Terminal 5 Portland, Oregon	FIGURE 3



HAI Project No. 4339 November 1999	**HAHN AND ASSOCIATES** INCORPORATED ENVIRONMENTAL MANAGEMENT 434 NW SIXTH AVENUE, SUITE 203 PORTLAND, OREGON 97209	**Groundwater Elevation Map** **October 19, 1999** Port of Portland, "Blue Lagoon" Site Terminal 5 Portland, Oregon	FIGURE 5

Attachment D
1995 Characterization of Fill Material
Port of Portland Terminal 5

centurywest
ENGINEERING CORPORATION

December 1, 1995

Mr. Pad Quinn
Port of Portland
PO Box 3529
Portland, Oregon 97208

RE: Sampling and Analysis of Fill Soil for Terminal 5
Rivergate Industrial District
Portland, Oregon

Dear Pad:

Century West Engineering Corporation (Century West) was retained by the Port of Portland to perform soil sampling of fill material to be used at the Port of Portland's Marine Terminal 5. The investigation of potential contamination of petroleum hydrocarbons, metals, and volatile organics consisted of obtaining representative composite soil samples from approximately 200,000 cubic yards of soil staged at seven locations in the Rivergate Industrial District.

This letter report presents sample locations and collection activities and analytical test results compared to the Oregon Soil Cleanup Table presented as Appendix 1 in the Oregon Department of Environmental Quality's (DEQ) Soil Cleanup Table (OAR 340-122-045 and 046).

Soil Sample Locations and Activities

The focus of the fill sampling program was to collect chemical and physical data to explore the presence of petroleum hydrocarbons, total organic halogens, and total metals (arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver) in composite soil samples collected from seven fill sources. One composite soil sample, consisting of soil from four locations, was obtained for each approximated 10,000 cubic yards.

The fill sources were all located within the Rivergate Industrial District on properties owned by the Port of Portland. Each fill source location was identified numerically as Site 1 through Site 7 (Figure 1) and contained varying amounts of fill material. Figures 2 through 8 show Sites 1 through 7, respectively, and soil sampling locations. Each site was divided into sections approximately 10,000 cubic yards in volume and labeled alphabetically. One composite soil sample was obtained from each section. Soil samples were labeled according to which site and which section of the site they were obtained (e.g., Sample S-1A was obtained from site 1, section A). Table 1, attached, describes each of the sites, including a brief description of the soil types and approximately depths tat the samples were obtained.

825 N.E. Multnomah, Suite 425 Portland, Oregon 97232 Phone: (503) 231-6078 FAX: (503) 231-6482

Sample Collection Procedures

Century West implemented the Port of Portland's Sampling and Analysis Plan - Fill Sources for Terminal 5, dated July 1995. Composite samples were obtained by approximating 10,000 cubic yards, spacing four stakes within that volume, and collecting a soil sample and headspace sample from each location into laboratory-prepared sample containers. The four soil samples were then mixed in a decontaminated stainless steel bowl and placed into a clean, laboratory-prepared container. Soil samples were collected at depths varying from one-half to four feet.

Samples collected were screened in the field for visual indications of petroleum hydrocarbons and were subjected to a headspace test with a photoionization detector (PID) to assess the possible presence of volatile organic compounds. The headspace test was conducted by placing soil from each discrete sampling location into glass jars (filled less than half full), covered with aluminum foil prior to capping, and allowing to warm to room temperature. Measurements were made within one-half hour of collection by pushing the PID probe through the foil cover. The PID was calibrated using a manufacturer supplied standard gas. The headspace readings were used to determine if analysis for halogenated solvents was necessary.

A chain-of-custody record was used to track possession of each sample and document the requested analyses. The chain-of-custody record accompanied the samples from sample preparation to sample analysis.

To minimize the potential for cross-contamination, all sampling equipment was cleaned before each sample collection. The decontamination procedure consisted of washing with an Alconox® solution, rinsing with tap water, and rinsing with distilled water.

Analytical Testing and Results

All of the composite soil samples were submitted for analysis for total petroleum hydrocarbons (TPH) identification using Oregon DEQ Method TPH-HCID and for total metals (arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver) using EPA Methods 6010 and 7470. Analytical test results did not reveal TPH in any of the soil samples. Headspace readings for all of the samples were zero. Therefore, in accordance with the Port's directions, none of the samples were submitted for halogenated organics analysis. Table 2, attached, summarizes the analytical test results for total metals and includes cleanup levels for Industrial Sites from DEQ's Soil Cleanup Manual, Appendix 1. Analytical laboratory reports are included as an attachment.

Concentrations of barium, chromium, lead, mercury, selenium, and silver are well below cleanup

levels for industrial. Cadmium was not detected in any of the soil samples. Arsenic was detected at concentrations slightly above the industrial cleanup level of 3 ppm in soils at site 2 and site 3. The highest detected concentration of arsenic was 4.07 ppm and was obtained from site 3. Arsenic is a common background element in this area and, given the low levels of arsenic detected, Century West recommends no further action regarding the soil at sites 2 and 3.

This recommendation is supported by Century West's Remedial Investigation/Feasibility Study (RI/FS) for the Schnitzer Moody Avenue property, dated May 1990, and the South Waterfront Redevelopment Area, dated October 2, 1992 (Figure 9). The projects included collection of twenty two soil samples from investigative borings and test pits for analysis for total metals. Statistical analysis of the test data established a background level for arsenic of 46.0 ppm for the Schnitzer Moody Avenue property. The DEQ requested additional supporting data for the arsenic background level for the South Waterfront Area. The data used to calculate the arsenic background concentration of 46.0 ppm was re-analyzed in accordance with EPA guidelines to verify that there were no outliers in the data set. As recommended by the DEQ, the arithmetic mean of the arsenic data, plus two standard deviations were used to establish the upper bound of the arsenic data at the 95 percent confidence level. Based on this statistical analysis, 36.1 ppm was established as the background for arsenic in soil.

Please call the undersigned at (503) 231-6078 if you have any questions regarding this project.

Sincerely,

Alice J. Larsen
Project Manager

Thomas B. Gainer, P.E.
Senior Environmental Engineer

Attachments:

Table 1 - Fill Source Sampling Sites
Table 2 - Analytical Test Results - Total Metals

Figure 1 - Site Vicinity Map
Figure 2 - Site 1
Figure 3 - Site 2
Figure 4 - Site 3
Figure 5 - Site 4

TABLES

TABLE 1
FILL SOURCE SAMPLING SITES

Port of Portland
Rivergate Industrial District
Portland, Oregon

Fill Source Identification	*Site Location*	*Cubic Yards*	*No. of Samples*	*Comments*
Site 1	On the south site of North Marine Drive between North Bybee Lake and NW Factory Group, Inc.	50,000	5	Fill material consisted of loose, gray, medium sand and was stockpiled on the site. Samples from the top of the pile to were obtained 2 to 4 feet below ground surface (bgs). Soil samples along the south side of the pile were obtained 7 to 12 feet from the top of the pile.
Site 2	Just inside and to the north of the gates to Western Transportation on North Rivergate Blvd	35,000	2	Fill material consisted of brown, hard, fine to medium sands. The material was above-grade and covered with vegetation. Soil samples were collected between 1 and 4-½ feet bgs.
Site 3	Under transmission power lines on both sides of Time Oil Road, just south of Western Transportation	100,000	10	Fill on west side of road consisted of unearthed sandy soils on a future wetland mitigation site. Unearthed sandy soil with barkdust to 8 inches in some areas was sampled on the east side of the road. Soil samples were obtained between ½ and 3-½ feet bgs.
Site 4	On North Lombard Street, across from Land O'Lakes	50,000	5	Approximately one-half of fill was stockpiled and the rest was surface scrapings. All of the soil consisted of loose, gray, well-sorted sand. Soil samples were obtained ½ to 3 feet bgs in the surface scrapings. The soils obtained from the pile were collected between 1 and 6 feet from the top of the pile.
Site 5	North of Access Road to Terminal 5	15,000	2	Fill material consisted of loose, sandy soils. The material was above-grade and covered with vegetation. Soil samples were obtained from depths between 2 and 5 bgs.

TABLE 1 (Cont.)
FILL SOURCE SAMPLING SITES

Port of Portland
Rivergate Industrial District
Portland, Oregon

Fill Source Identification	*Site Location*	*Cubic Yards*	*No. of Samples*	*Comments*
Site 6	South corner of Terminal 5, near Oregon Steel Mill's lagoon and Union Pacific railroad	15,000	2	Most of the fill was loose, gray medium sand. Some was gravel ½" minus and sand. Most of the fill was stockpiled in several small piles and one large pile. The rest was spread around. Samples were collected from selected piles approximately 3 feet below the top of the pile. Samples were obtained from ½ to 2-1/2 feet below grade in the soil that was spread around.
Site 7	Future extension of North Leadbetter Road	15,000	2	Fill was loose, brown, sandy surface scrapings. Soil samples were obtained from the surface down to approximately 1 foot below grade.

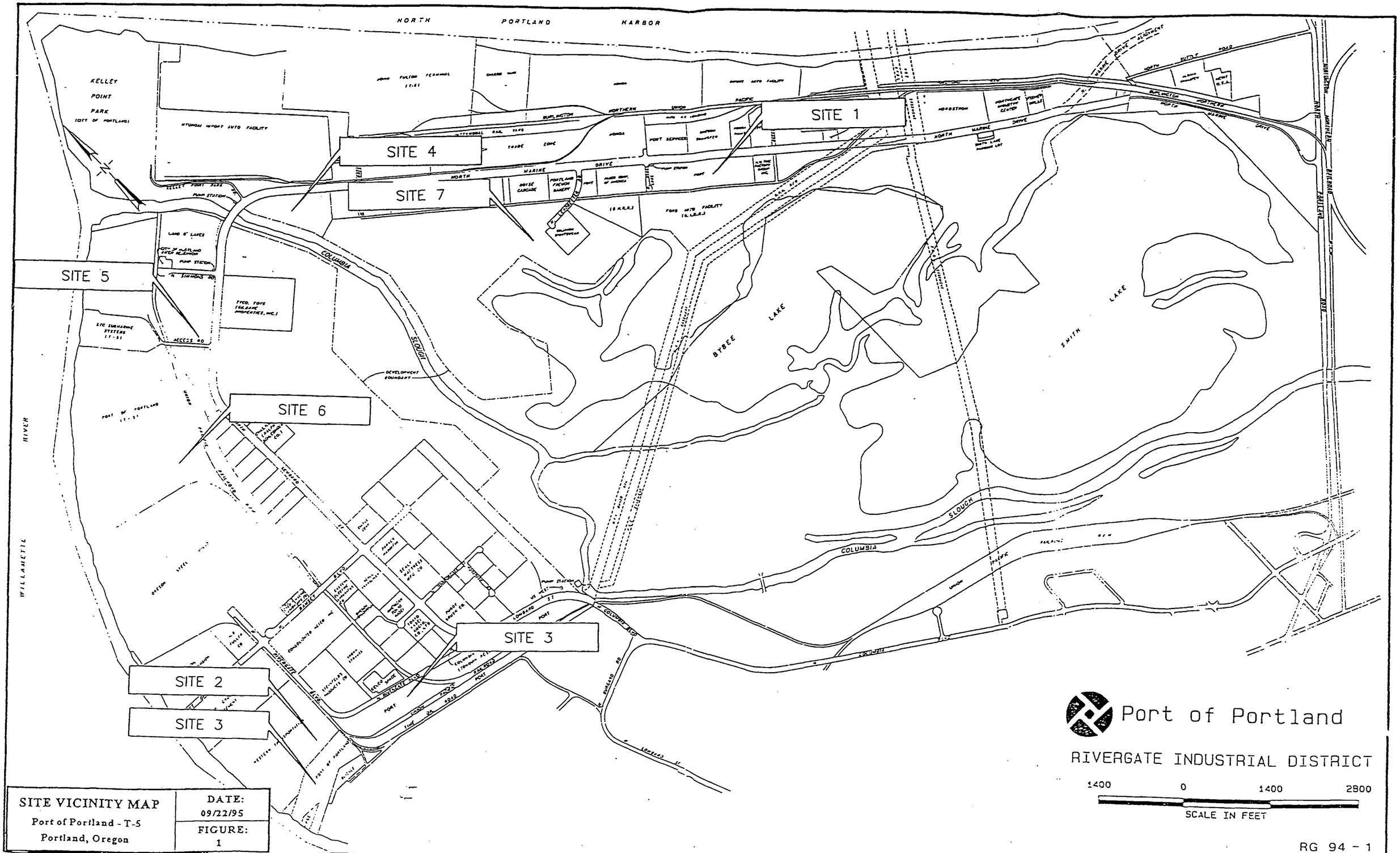
TABLE 2
ANALYTICAL TEST RESULTS - TOTAL METALS

Port of Portland
Rivergate Industrial District
Portland, Oregon

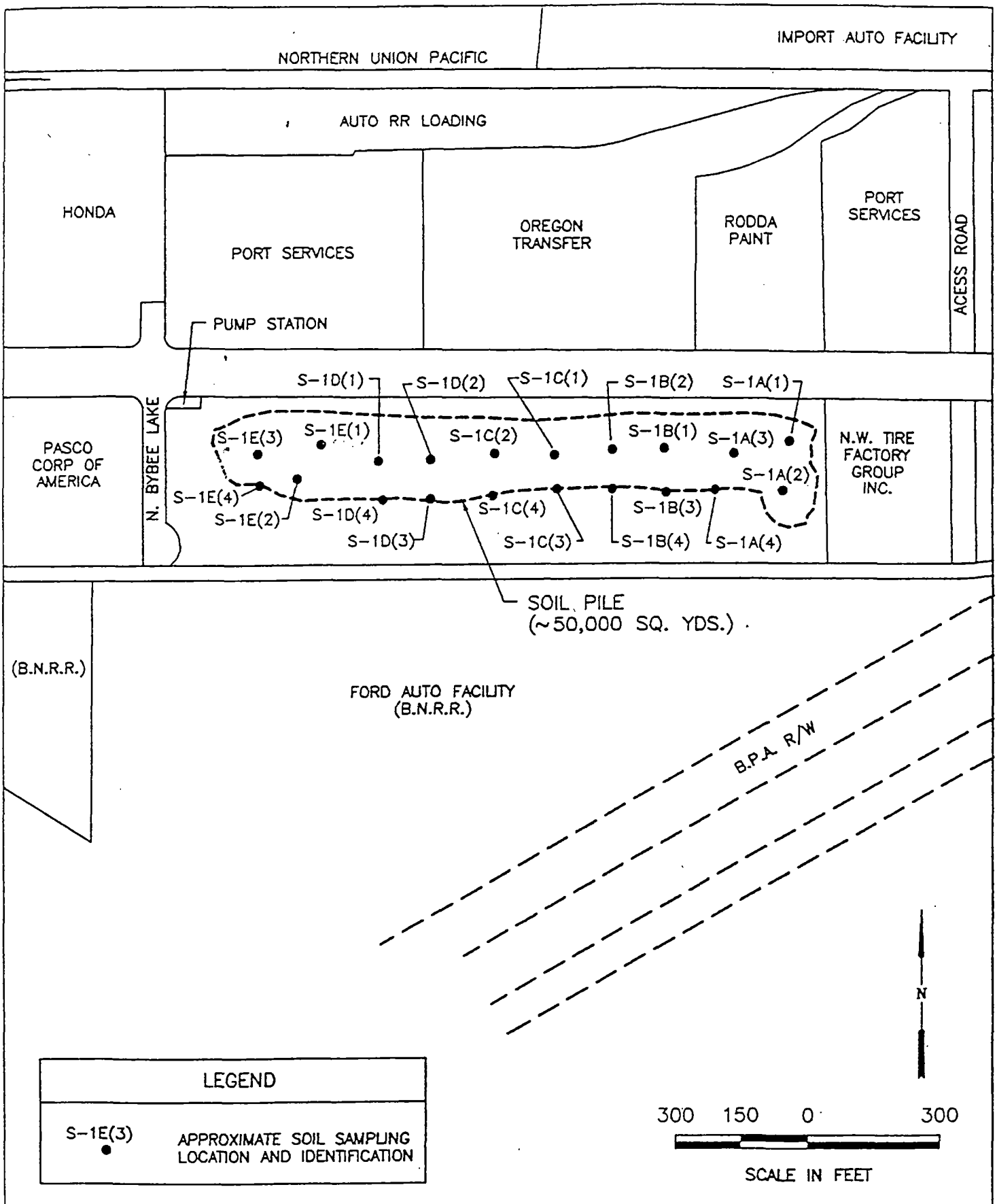
Sample Identification	Concentration in Parts per Million (ppm)							
	Arsenic	Barium	Cadmium	Chromium	Lead	Mercury	Selenium	Silver
S-1A	1.56	47.9	<0.2	10.6	<2.5	<0.02	<5.0	<0.3
S-1B	1.52	54.4	<0.2	10.2	3.4	0.02	<5.0	<0.3
S-1C	1.56	62.8	<0.2	11.2	<2.5	<0.02	<5.0	<0.3
S-1D	1.83	59.7	<0.2	11.4	<2.5	<0.02	<5.0	<0.3
S-1E	1.74	50	<0.2	9.22	2.6	<0.02	<5.0	<0.3
S-2A	3.6	74.5	<0.2	14.7	8	0.024	<5.0	<0.3
S-2B	3.67	84.6	<0.2	17.1	6.6	<0.02	<5.0	<0.3
S-3A	4	79.8	<0.2	17.2	5.6	0.021	<5.0	<0.3
S-3B	3.65	69.7	<0.2	17.5	6.4	0.021	<5.0	<0.3
S-3C	2.9	71.2	<0.2	11.8	5.3	0.023	<5.0	<0.3
S-3D	2.9	54.5	<0.2	11.8	2.7	0.021	<5.0	<0.3
S-3E	3.2	80.8	<0.2	13.4	5.9	0.036	<5.0	<0.3
S-3F	3.97	83.8	<0.2	18	6	0.023	<5.0	<0.3
S-3G	3.71	74	<0.2	14.5	4.08	<0.02	<5.0	<0.3
S-3H	3.94	81.9	<0.2	15.9	6.9	0.032	<5.0	<0.3
S-3I	4.07	82.4	<0.2	16.5	3.3	0.024	<5.0	<0.3
S-3J	3.92	80.8	<0.2	16.1	3.9	<0.02	<5.0	<0.3
S-3Z								
(Duplicate of S-3G)	3.7	79.8	<0.2	15.2	5.4	<0.02	<5.0	<0.3
S-4A	1.5	55.2	<0.2	10.6	<2.5	<0.02	<5.0	<0.3
S-4B	1.7	59.8	<0.2	11.8	<2.5	<0.02	<5.0	<0.3
S-4C	1.6	49.7	<0.2	12.1	<2.5	<0.02	<5.0	<0.3
S-4D	1.5	49.4	<0.2	8.88	<2.5	<0.02	<5.0	<0.3
S-4E	1.4	56.4	<0.2	13.8	3.2	<0.02	<5.0	<0.3
S-4Z								
(Duplicate of S-4D)	1.5	50.4	<0.2	9.75	<2.5	<0.02	<5.0	<0.3
S-5A	1.5	65.9	<0.2	13.7	3.3	<0.02	<5.0	<0.3
S-5B	1.3	83.8	<0.2	22	4	0.022	<5.0	<0.3
S-6A	1.8	43.1	<0.2	10.3	3.5	0.02	<5.0	<0.3
S-6B	1	90.8	<0.2	13.6	5	0.023	<5.0	<0.3
S-7A	1.5	92.3	<0.2	7.43	2.8	0.025	<5.0	<0.3
S-7B	1.9	74	<0.2	11.3	4.9	<0.02	<5.0	<0.3
	Soil Cleanup Levels in ppm (OAR 340-122-045)							
Industrial Sites	3	140,000	1.00	1,000	1,500	2,000	600	10,000

Notes:
Total Metals performed using EPA Method 6010 and 7470.
Sample Identification indicates sampling site number which section of the site the sample was obtained (see Figures 1 through 8)
'<' means less than
Soil Cleanup Levels are from DEQ's Soil Cleanup Manual Table, Appendix 1.

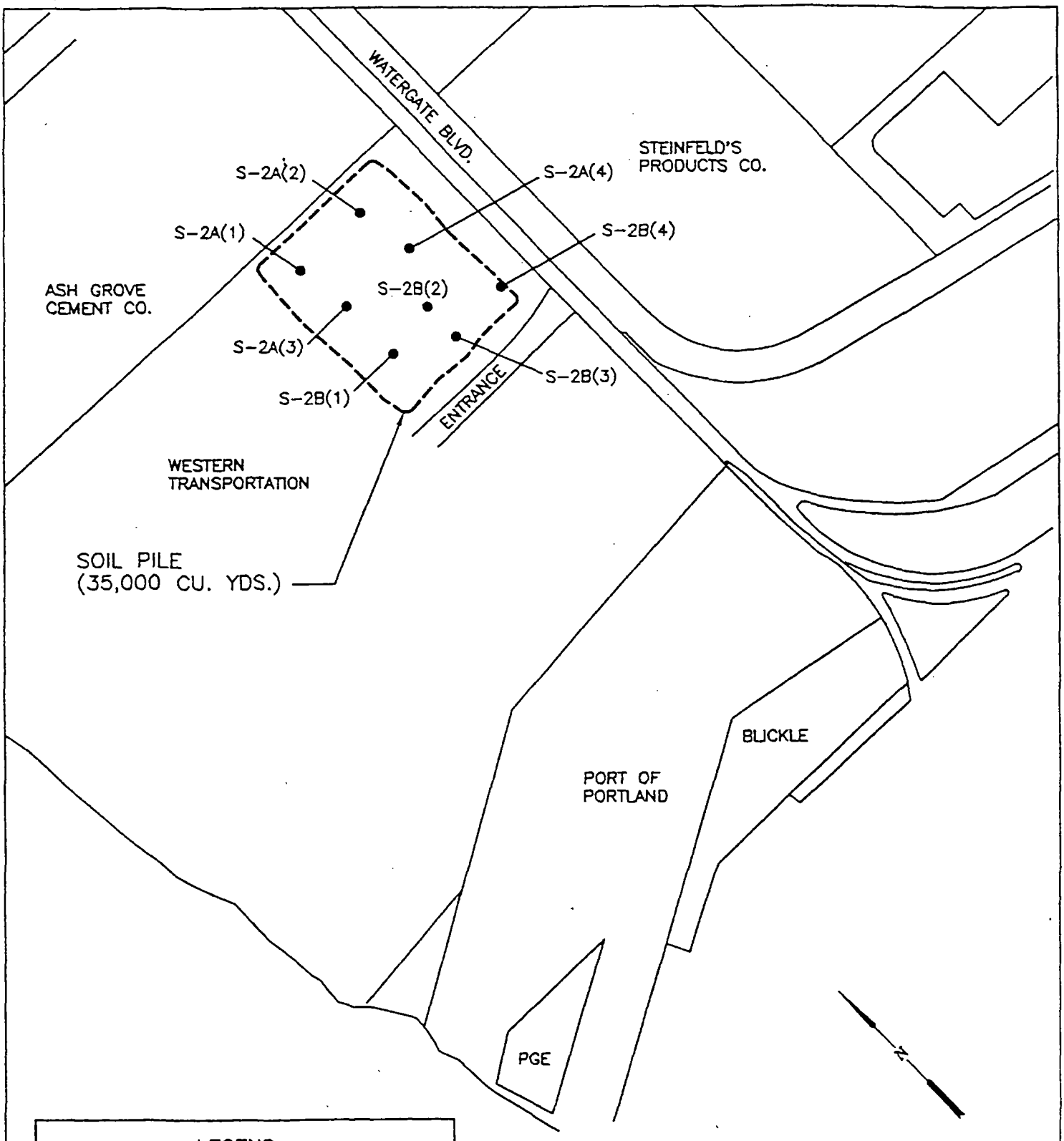
FIGURES



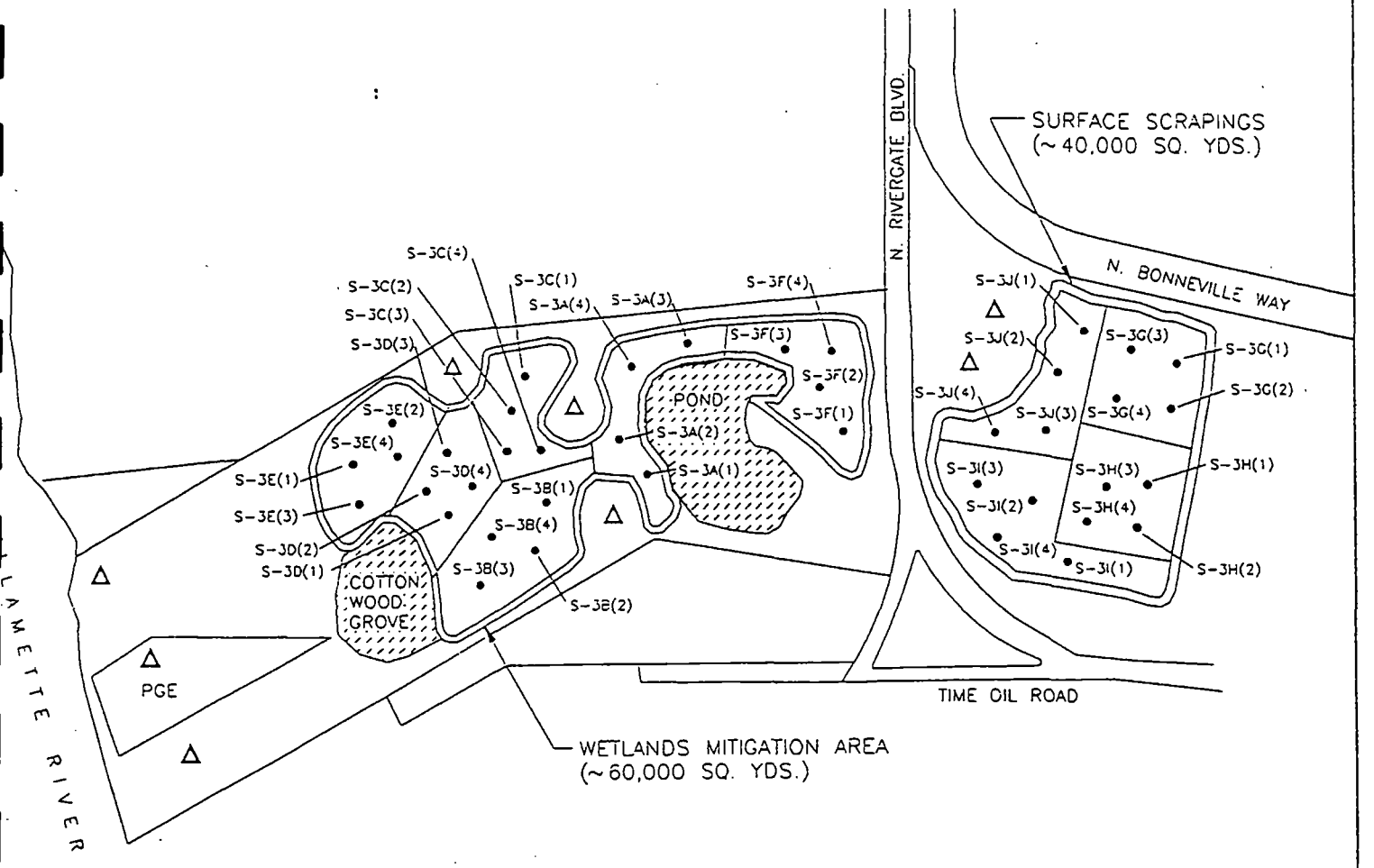
SITE VICINITY MAP	DATE: 09/22/95
Port of Portland - T-5 Portland, Oregon	FIGURE: 1



DESIGNED BY: AL	CHECKED BY:	SITE 1 PORT OF PORTLAND T-5 PORTLAND, OREGON	centurywest ENGINEERING CORPORATION
DRAWN BY: DMC	SCALE: AS SHOWN		DATE: 09/14/95
FILE: 40038101\01\3129\30ZF2			FIGURE: 2



DESIGNED BY: AL	CHECKED BY:	SITE 2 PORT OF PORTLAND T-5 PORTLAND, OREGON	centurywest ENGINEERING CORPORATION	DATE: 11/30/95
DRAWN BY: DMC	SCALE: AS SHOWN			FIGURE: 3
FILE: 40038101\01\3129\48JFIG3				



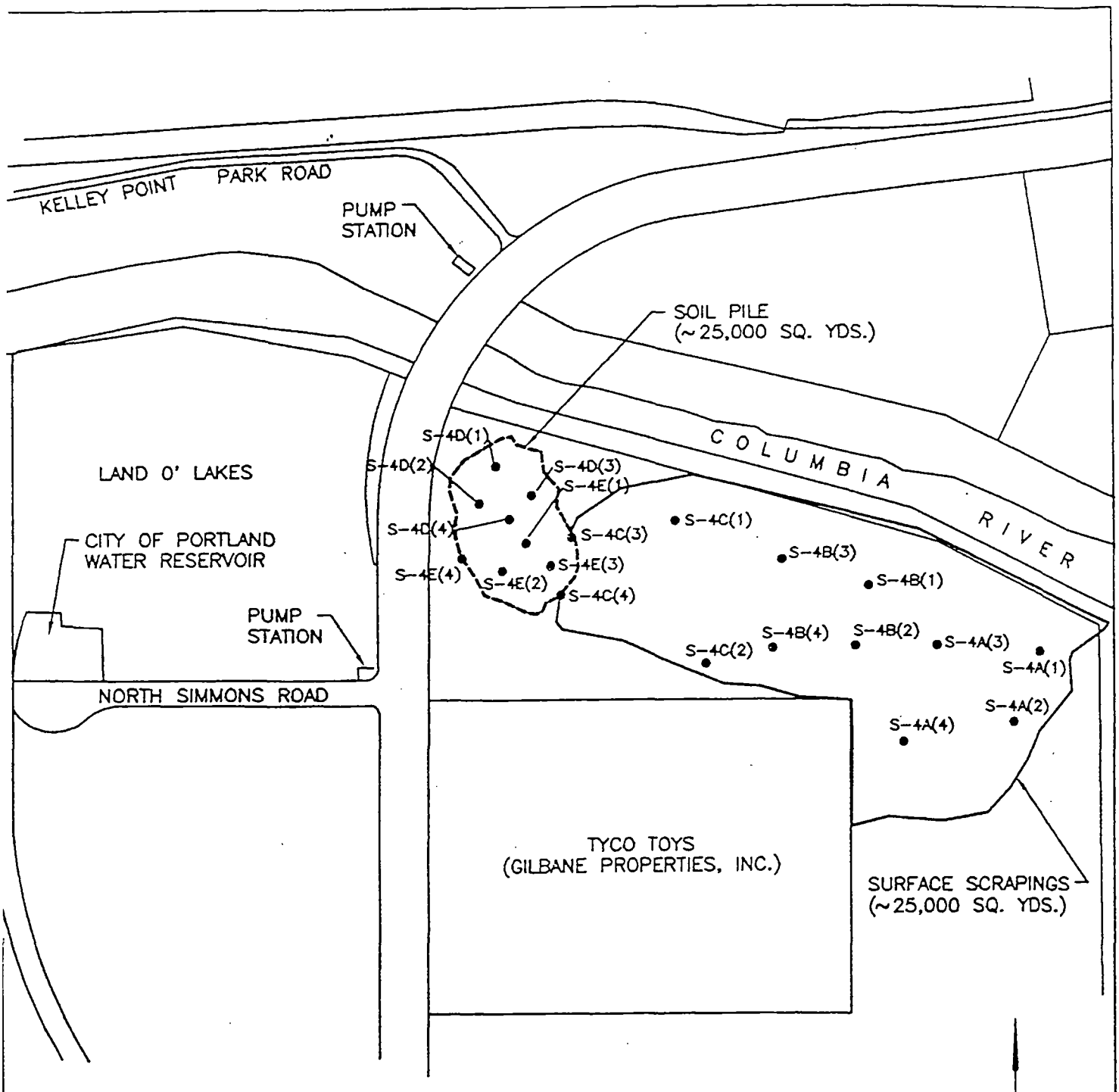
LEGEND	
S-3H(4) •	APPROXIMATE SOIL SAMPLING LOCATION AND IDENTIFICATION
△	TRANSMISSION TOWER

N

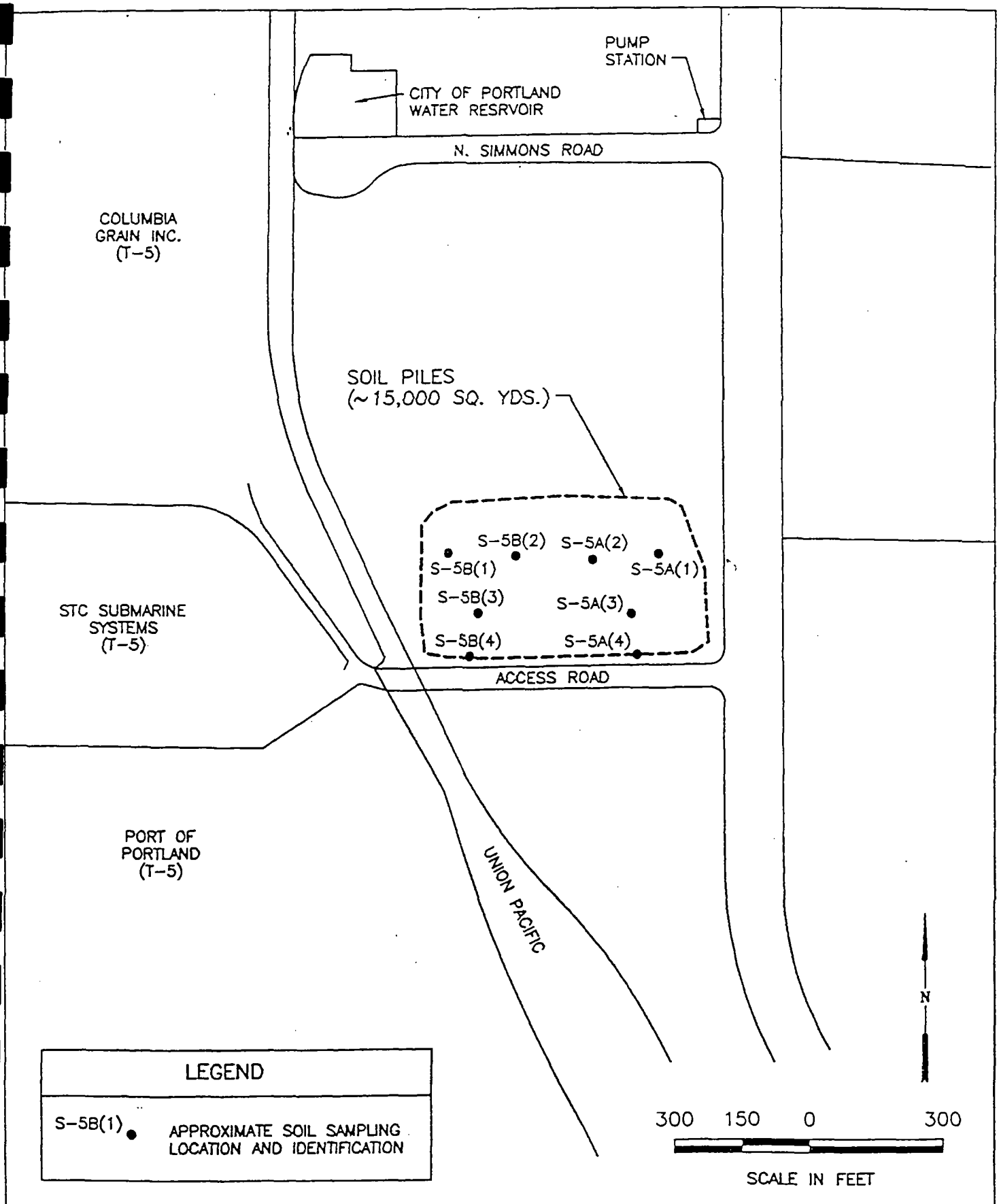
300 150 0 300

SCALE IN FEET

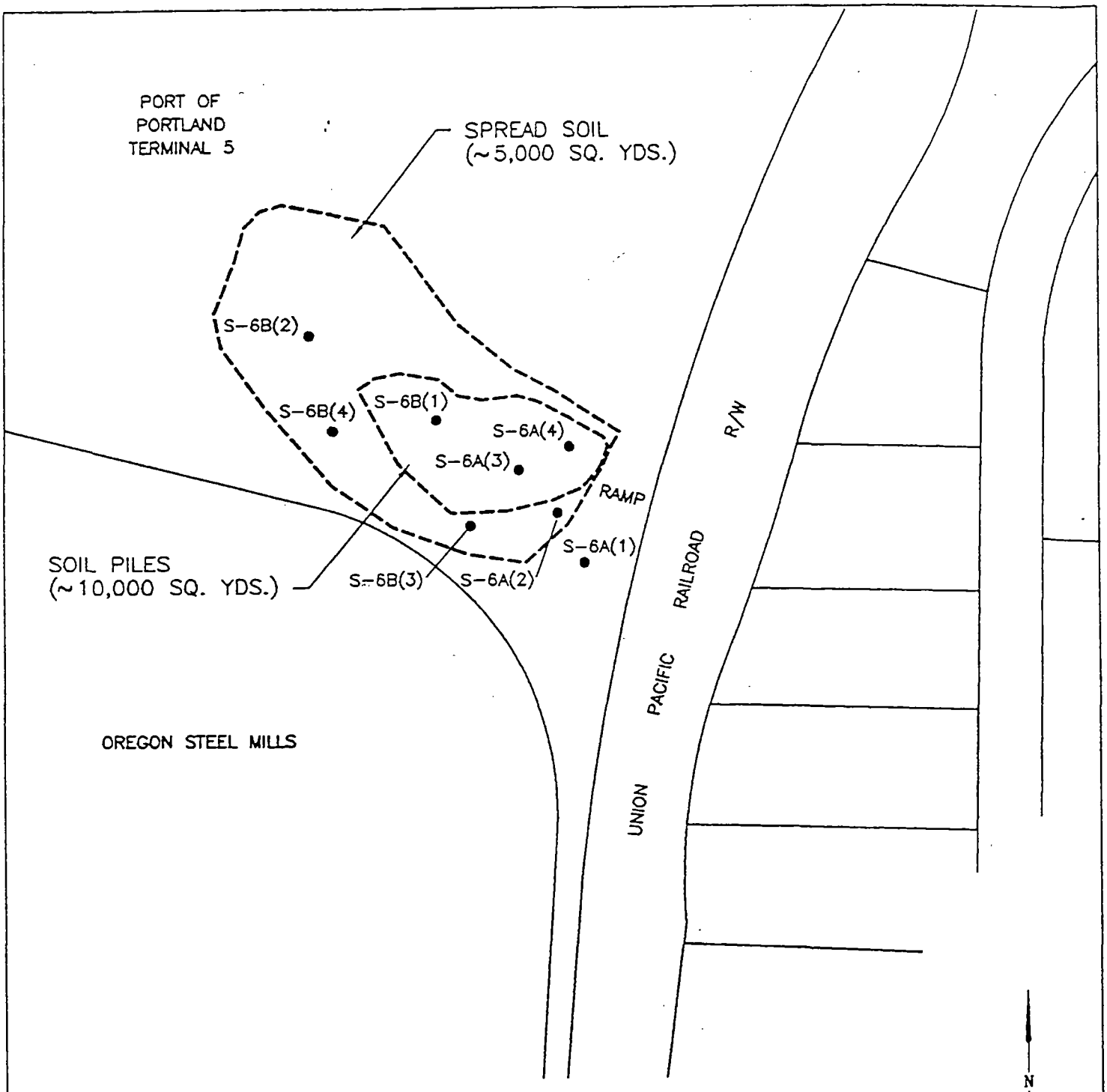
DESIGNED BY: AL	CHECKED BY:	SITE 3 PORT OF PORTLAND T-5 PORTLAND, OREGON	centurywest ENGINEERING CORPORATION	DATE: 09/14/95
DRAWN BY: DMC	SCALE: AS SHOWN			FIGURE: 4
FILE: 40038101\01\3129\3P8F4				



DESIGNED BY: AL	CHECKED BY:	SITE 4 PORT OF PORTLAND T-5 PORTLAND, OREGON	centurywest ENGINEERING CORPORATION	DATE: 09/14/95
DRAWN BY: DMC	SCALE: AS SHOWN			FIGURE: 5
FILE: 40038101\01\3129\3PBF5				

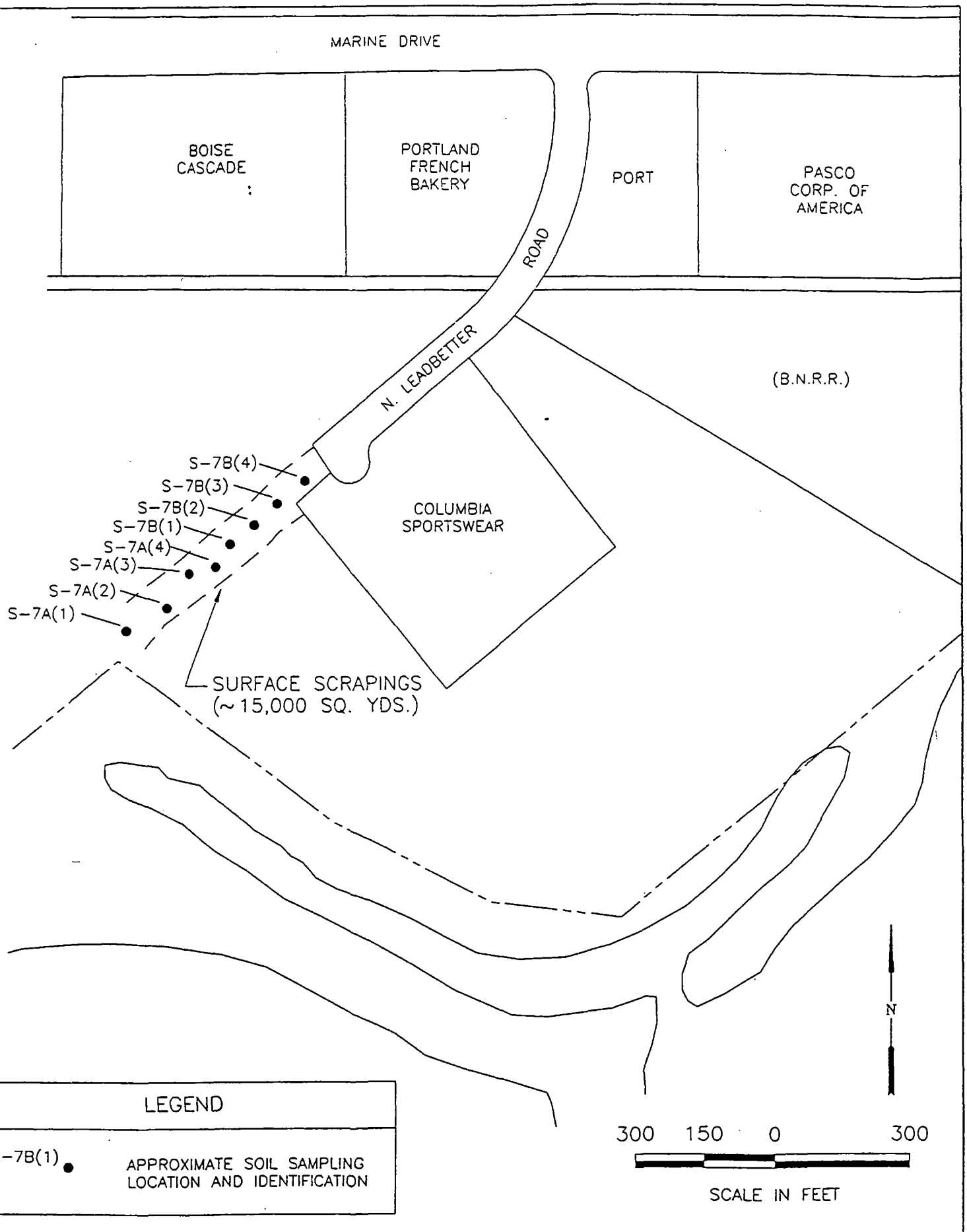


DESIGNED BY: AL	CHECKED BY:	SITE 5 PORT OF PORTLAND T-5 PORTLAND, OREGON	centurywest ENGINEERING CORPORATION	DATE: 09/14/95
DRAWN BY: DMC	SCALE: AS SHOWN			FIGURE: 6
FILE: 40038101\01\3129\3PPF6				

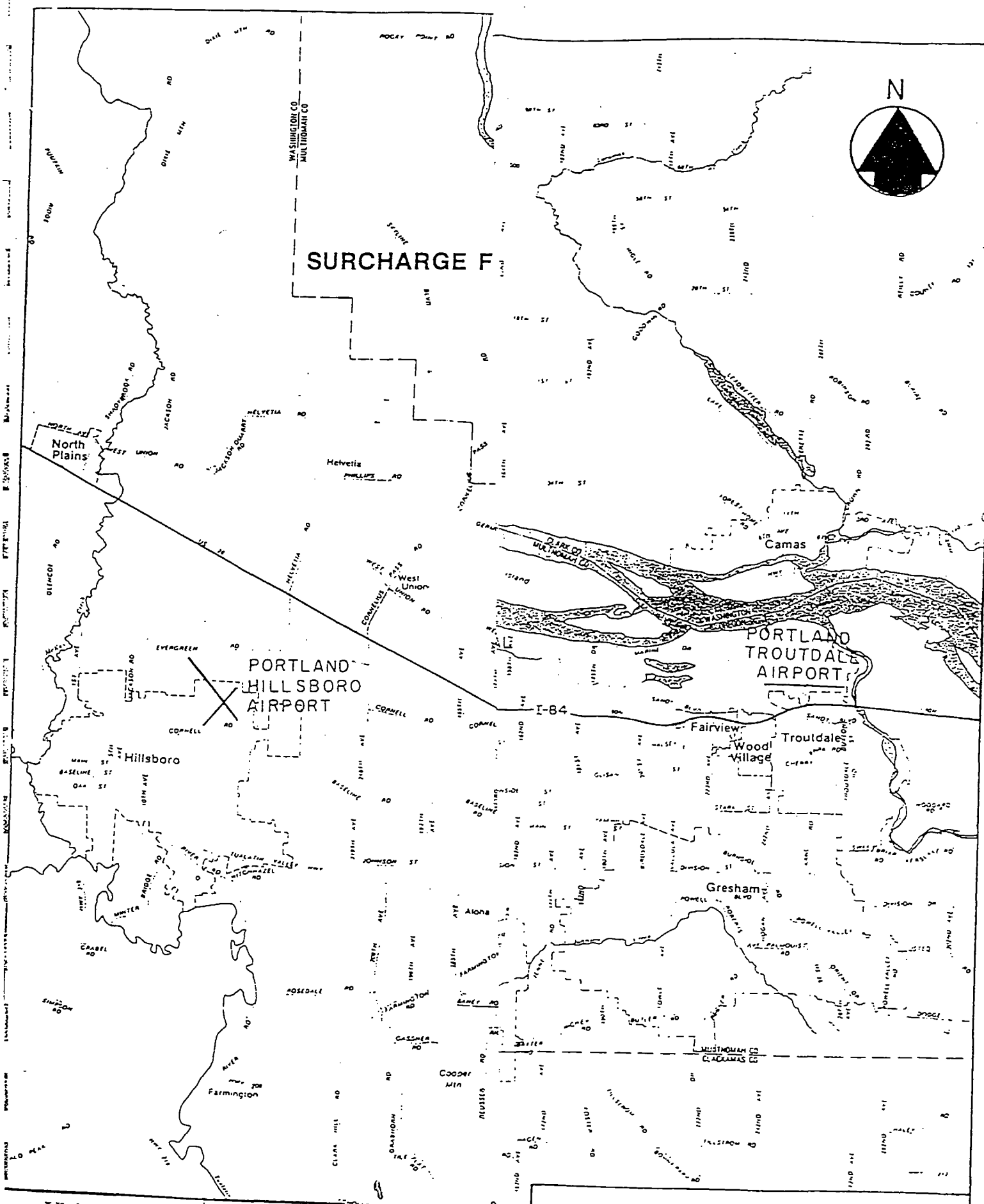


LEGEND	
S-6B(2) ●	APPROXIMATE SOIL SAMPLING LOCATION AND IDENTIFICATION

DESIGNED BY: AL	CHECKED BY:	SITE 6 PORT OF PORTLAND T-5 PORTLAND, OREGON	DATE: 09/14/95
DRAWN BY: DMC	SCALE: AS SHOWN	centurywest ENGINEERING CORPORATION	FIGURE: 7
FILE: 40078101\01\3120\3PC57			



DESIGNED BY: AL	CHECKED BY:	SITE 7 PORT OF PORTLAND T-5 PORTLAND, OREGON	DATE: 09/14/95
DRAWN BY: DMC	SCALE: AS SHOWN	centurywest ENGINEERING CORPORATION	FIGURE: 8
FILE: 40038101\01\3129\3PHF8			



Vicinity Map
Port of Portland - T-5
Portland, Oregon

DATE:
Dec. 1, 1995

FIGURE:
9

PORT OF PORTLAND
OPERATING FACILITIES
LOCATION MAP

ANALYTICAL LABORATORY REPORTS

OAL

CENTURY WEST ENGINEERING
825 NE MULTNOMAH, SUITE 425
PORTLAND, OR 97232

ANALYST REVIEW BY: RJ DATE: 8/1/95

DATA PACK REVIEW BY: JB DATE: 8/1/95

ALICE LARSEN
231-6078FAX 231-6482
R001322/40038-101-01

HYDROCARBON IDENTIFICATION (HCID)
BY OREGON DEQ TPH-HCID

SAMPLE ID:	S-1A	S-1B	S-1C	S-1D	S-1E
OAL ID: 25-I687-	39342	39343	39344	39345	39346
SAMPLE DATE:	7/27/95	7/27/95	7/27/95	7/27/95	7/27/95
MATRIX:	SOIL	SOIL	SOIL	SOIL	SOIL
EXTRACTION DATE:	7/28/95	7/28/95	7/28/95	7/28/95	7/28/95
ANALYSIS DATE:	7/30/95	7/30/95	7/30/95	7/30/95	7/30/95
HCID:	ND	ND	ND	ND	ND
HCID(CONTINUED):	.	.	.	.	.
SURR.RECOVERY %	99.	101.	110.	110.	117.
ANALYST:	RJ	RJ	RJ	RJ	RJ

ORTHO-TERPHENYL WAS USED AS THE SURROGATE
NA = NOT ANALYZED
GASOLINE REGION (C6 THRU C10)
DIESEL REGION (C10 THRU C28)
OIL AND BUNKER C REGION (BEYOND C28)
ND = NONE DETECTED (GASOLINE < 20 MG/KG, DIESEL < 50 MG/KG)
MI = MATRIX INTERFERENCE WITH SURROGATE RECOVERY

OREGON ANALYTICAL LABORATORY
A Division of Portland General Electric
14855 S.W. Old Scholls Ferry Road
Beaverton, OR 97007
Ph... 503.690.6700 • Fax 503.690.1404

OAL

CENTURY WEST ENGINEERING
825 NE MULTNOMAH, SUITE 425
PORTLAND, OR 97232

ANALYST REVIEW BY: DMC DATE: 8-1-95

DATA PACK REVIEW BY: KMB DATE: 8/1/95

ALICE LARSEN
231-6078FAX 231-6482
R001322/40038-101-01

TOTAL METALS
EPA METHODS 6010 AND 7470

SAMPLE ID:		S-1A	S-1B	S-1C	S-1D	S-1E
OAL ID: 25-I687-		39342	39343	39344	39345	39346
SAMPLE DATE:		7/27/95	7/27/95	7/27/95	7/27/95	7/27/95
DIGESTION DATE:		7/31/95	7/31/95	7/31/95	7/31/95	7/31/95
ARSENIC	PPM	1.56	1.52	1.56	1.83	1.74
BARIUM	PPM	47.9 *	54.4*	62.8 *	59.7 *	50.0 *
CADMIUM	PPM	<0.2	<0.2	<0.2	<0.2	<0.2
CHROMIUM	PPM	10.6	10.2	11.2	11.4	9.22
LEAD	PPM	<2.5	3.4	<2.5	<2.5	2.6
MERCURY	PPM	<0.02	0.022	<0.02	<0.02	<0.02
SELENIUM	PPM	<5.0	<5.0	<5.0	<5.0	<5.0
SILVER	PPM	<0.3	<0.3	<0.3	<0.3	<0.3

NA = NOT ANALYZED

* Spike recovery outside Q.C. limits. Post spike within limits.

OREGON ANALYTICAL LABORATORY
A Division of Portland General Electric
14855 S.W. Old Scholls Ferry Road
Beaverton, OR 97007
Phone 503-590-5300 • Fax 503-590-1404

OAL Analytical Laboratory
Beaverton, Oregon 97007
(503) 690-6300
FAX (503) 690-1404

CHAIN OF CUSTODY RECORD
LABORATORY ANALYSIS REQUEST

Client Information

Company: Century West
Contact: Alice Larsen
Address:
Phone #: 231-6078 FAX #:

Project Name: Port-Surcharge Sampl
Project Number: 40038-101-01
P.O. Number:
Comments: BILL PORT

Sampler's Name: Alice Larsen
Signature:
Sampling Date: 7/27/95

Provide Verbal Results ☐ Yes ☐ No
Provide FAX Results ☑ Yes ☐ No

	Sample Identification	Date	Time	OAL #	# of Containers	Matrix: Soil	Matrix: Water	Matrix: Other (Note in Remarks)	Analyses: Volatiles 624/8260 (circle) All Aromatic Halogenated	Semivolatiles 625/8270 (circle) All PAH(SIM) Phenol Phthalate	Organochlorinateds 608/8080 All PCB Pesticide (circle)	Chlorinated Herbicides 8150	TPH-HCID OR-DEQ Quantify? Yes No	TPH Quantification (circle) G D 418.1M 418.1	BTEX 602/8020	TCLP Metals (circle) As Ba Cd Cr Pb Hg Se Ag	TCLP Organics (circle) Vol Semivol Pest Herb	Metals ☐Dissolved ☐Total. List: SEE REMARKS				Turnaround	Remarks
				25.1687.																			
1	S-1A	7/27/95		39342	2								X				X	X					
2	S-1B			39343	2								X					X					
3	S-1C			39344	2								X					X					
4	S-1D			39345	2								X					X					
5	S-E			39346	2								X					X					
6																							
7																							
8																							
9																							
10																							

N - 2 weeks
S - 1 week
R - Rush
O - Other

Relinquished
Signature: [signature]
Print Name: [illegible]
Company:
Date: 7/28/95
Time: 10:00

Received
Signature:
Print Name:
Company:
Date:
Time:

Relinquished
Signature:
Print Name:
Company:
Date:
Time:

Received
Signature: [signature]
Print Name: Doug McKenzie
Company: OAL
Date: 7/28/95
Time: 10:00X

Shipped Via: Hand
Received @ 4 °C
Appropriate Containers ☑ Yes ☐ No

10 4oz./8oz. Jars
___ VOA Vials
___ Plastic Bottles
___ Glass Bottles
___ other

OAL

CENTURY WEST ENGINEERING
825 NE MULTNOMAH, SUITE 425
PORTLAND, OR 97232

ANALYST REVIEW BY: RJ DATE: 8/7/95
DATA PACK REVIEW BY: KWB DATE: 8/7/95

ALICE LARSEN
231-6078FAX 231-6482
R001322/40038-101-01

HYDROCARBON IDENTIFICATION (HCID) BY OREGON DEQ TPH-HCID

SAMPLE ID:	S-2A	S-2B	S-3Z	S-7A	S-7B
OAL ID: 25-I687-	39392	39393	39394	39395	39396
SAMPLE DATE:	7/28/95	7/28/95	7/28/95	7/28/95	7/28/95
MATRIX:	SOIL	SOIL	SOIL	SOIL	SOIL
EXTRACTION DATE:	8/2/95	8/2/95	8/2/95	8/2/95	8/2/95
ANALYSIS DATE:	8/2/95	8/2/95	8/2/95	8/2/95	8/2/95
HCID:	ND	ND	ND	ND	ND
HCID(CONTINUED):	.	.	.	.	.
SURR.RECOVERY %	119.	122.	101.	121.	87.
ANALYST:	RJ	RJ	RJ	RJ	RJ

ORTHO-TERPHENYL WAS USED AS THE SURROGATE
NA = NOT ANALYZED
GASOLINE REGION (C6 THRU C10)
DIESEL REGION (C10 THRU C28)
OIL AND BUNKER C REGION (BEYOND C28)
ND = NONE DETECTED (GASOLINE ≤ 20 MG/KG, DIESEL < 50 MG/KG)
NI = MATRIX INTERFERENCE WITH SURROGATE RECOVERY

OREGON ANALYTICAL LABORATORY
A Division of Portland General Electric
14855 S.W. Old Scholls Ferry Road
Beaverton, OR 97007
Phone 503-590-5300 • Fax 503-590-1404

OAL

CENTURY WEST ENGINEERING
825 NE MULTNOMAH, SUITE 425
PORTLAND, OR 97232

ANALYST REVIEW BY: TMW DATE: 8/11/95

DATA PACK REVIEW BY: ALB DATE: 8/11/95

ALICE LARSEN
231-6078FAX 231-6482
R001322/40038-101-01

TOTAL METALS
EPA METHODS 6010 AND 7470

SAMPLE ID:		S-2A	S-2B	S-3Z	S-7A	S-7B
OAL ID: 25-I687-		39401	39402	39403	39404	39405
SAMPLE DATE:		7/28/95	7/28/95	7/28/95	7/28/95	7/28/95
DIGESTION DATE:		7/31/95	7/31/95	7/31/95	7/31/95	7/31/95
ARSENIC	PPM	3.6	3.67	3.7	1.5	1.9
BARIUM	PPM	74.5	84.6	79.8	92.3	74.0
CADMIUM	PPM	<0.2	<0.2	<0.2	<0.2	<0.2
CHROMIUM	PPM	14.7	17.1	15.2	7.43	11.3
LEAD	PPM	8.0	6.6	5.4	2.8	4.9
MERCURY	PPM	0.024	<0.02	<0.02	0.025	<0.02
SELENIUM	PPM	<5.0	<5.0	<5.0	<5.0	<5.0
SILVER	PPM	<0.3	<0.3	<0.3	<0.3	<0.3

NA = NOT ANALYZED

OREGON ANALYTICAL LABORATORY
A Division of Portland General Electric
14855 S.W. Old Scholls Ferry Road
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OAL

CENTURY WEST ENGINEERING
825 NE MULTNOMAH, SUITE 425
PORTLAND, OR 97232

ANALYST REVIEW BY: TMW DATE: 8/11/95

DATA PACK REVIEW BY: ALB DATE: 8/11/95

ALICE LARSEN
231-6078FAX 231-6482
R001322/40038-101-01

TOTAL METALS
EPA METHODS 6010 AND 7470

SAMPLE ID:		S-2A	S-2B	S-3Z	S-7A	S-7B
OAL ID: 25-I687-		39401	39402	39403	39404	39405
SAMPLE DATE:		7/28/95	7/28/95	7/28/95	7/28/95	7/28/95
DIGESTION DATE:		7/31/95	7/31/95	7/31/95	7/31/95	7/31/95
ARSENIC	PPM	3.6	3.67	3.7	1.5	1.9
BARIUM	PPM	74.5	84.6	79.8	92.3	74.0
CADMIUM	PPM	<0.2	<0.2	<0.2	<0.2	<0.2
CHROMIUM	PPM	14.7	17.1	15.2	7.43	11.3
LEAD	PPM	8.0	6.6	5.4	2.8	4.9
MERCURY	PPM	0.024	<0.02	<0.02	0.025	<0.02
SELENIUM	PPM	<5.0	<5.0	<5.0	<5.0	<5.0
SILVER	PPM	<0.3	<0.3	<0.3	<0.3	<0.3

NA = NOT ANALYZED

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CENTURY WEST ENGINEERING
825 NE MULTNOMAH, SUITE 425
PORTLAND, OR 97232

ANALYST REVIEW BY: RJ DATE: 8/7/95
DATA PACK REVIEW BY: KWB DATE: 8/7/95

ALICE LARSEN
231-6078FAX 231-6482
R001322/40038-101-01

HYDROCARBON IDENTIFICATION (HCID)
BY OREGON DEQ TPH-HCID

SAMPLE ID:	S-3H	S-3J	S-3I	S-3G
OAL ID: 25-I687-	39397	39398	39399	39400
SAMPLE DATE:	7/27/95	7/27/95	7/27/95	7/27/95
MATRIX:	SOIL	SOIL	SOIL	SOIL
EXTRACTION DATE:	8/2/95	8/2/95	8/3/95	8/2/95
ANALYSIS DATE:	8/2/95	8/2/95	8/3/95	8/2/95
HCID:	ND	ND	ND	ND
HCID(CONTINUED):	.	.	.	.
SURR.RECOVERY %	105.	92.	113.	104.
ANALYST:	RJ	RJ	RJ	RJ

ORTHO-TERPHENYL WAS USED AS THE SURROGATE
NA = NOT ANALYZED
GASOLINE REGION (C6 THRU C10)
DIESEL REGION (C10 THRU C28)
OIL AND BUNKER C REGION (BEYOND C28)
ND = NONE DETECTED (GASOLINE < 20 MG/KG, DIESEL < 50 MG/KG)
MI = MATRIX INTERFERENCE WITH SURROGATE RECOVERY

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CENTURY WEST ENGINEERING
825 NE MULTNOMAH, SUITE 425
PORTLAND, OR 97232

ANALYST REVIEW BY: TMW DATE: 8/11/95

DATA PACK REVIEW BY: ALB DATE: 8/11/95

ALICE LARSEN
231-6078FAX 231-6482
R001322/40038-101-01

TOTAL METALS
EPA METHODS 6010 AND 7470

SAMPLE ID:		S-3H	S-3J	S-3I	S-3G
OAL ID: 25-I687-		39406	39407	39408	39409
SAMPLE DATE:		7/27/95	7/27/95	7/27/95	7/27/95
DIGESTION DATE:		7/31/95	7/31/95	7/31/95	7/31/95
ARSENIC	PPM	3.94	3.92	4.07	3.71
BARIUM	PPM	81.9	80.8	82.4	74.0
CADMIUM	PPM	<0.2	<0.2	<0.2	<0.2
CHROMIUM	PPM	15.9	16.1	16.5	14.5
LEAD	PPM	6.9	3.9	3.3	4.08
MERCURY	PPM	0.032	<0.02	0.024	<0.02
SELENIUM	PPM	<5.0	<5.0	<5.0	<5.0
SILVER	PPM	<0.3	<0.3	<0.3	<0.3

NA = NOT ANALYZED

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Phone 503-590-5300 • Fax 503-590-1404

OAL Oregon Analytical Laboratory
14855 S.W. Old Scholls Ferry Rd.
Beaverton, Oregon 97007
(503) 590-5300
FAX (503) 590-1404

CHAIN OF CUSTODY RECORD
LABORATORY ANALYSIS REQUEST

Page 1 of 1

Client Information

Company: Century West
Contact: Alice Larsen
Address: 825 NE Multnomah Ste 425
PDX 97232
Phone #: FAX #:

Project Name: Port - Surcharge Sampling
Project Number: 40038-101.01
P.O. Number:
Comments: BILL PORT

Sampler's Name: Alice Larsen
Signature:
Sampling Date: 7-25 7-28-95

Provide Verbal Results: ☒ Yes ☐ No
Provide FAX Results: ☒ Yes ☐ No

	Sample Identification	Date	Time	TPH HCID OAL # 25-I687-	# of Containers	Matrix: Soil	Matrix: Water	Matrix: Other (Note in Remarks)	Analyses	Turnaround	Remarks
1	S-2A	7/27/95		39392	2				TPH-HCID OR-DEQ Quantify? Yes; RCRA 8 Metals Dissolved		39401
2	S-2B	7/28/95		39393	2				TPH-HCID OR-DEQ Quantify? Yes; RCRA 8 Metals Dissolved		39402
3	S-3E			39394	1				TPH-HCID OR-DEQ Quantify? Yes; RCRA 8 Metals Dissolved		39403
4	S-7A			39395	2				TPH-HCID OR-DEQ Quantify? Yes; RCRA 8 Metals Dissolved		39404
5	S-7B			39396	2				TPH-HCID OR-DEQ Quantify? Yes; RCRA 8 Metals Dissolved		39405
6	S-3H	7/27/95		39397	2				TPH-HCID OR-DEQ Quantify? Yes; RCRA 8 Metals Dissolved		39406
7	S-3J			39398	2				TPH-HCID OR-DEQ Quantify? Yes; RCRA 8 Metals Dissolved		39407
8	S-3I			39399	1				TPH-HCID OR-DEQ Quantify? Yes; RCRA 8 Metals Dissolved		39408
9	S-3G			39400	2				TPH-HCID OR-DEQ Quantify? Yes; RCRA 8 Metals Dissolved		39409
10											

Turnaround: (N - 2 weeks) S - 1 week R - Rush O - Other

Remarks: metals

Relinquished
Signature:
Print Name: Alice J Larson
Company: Century West
Date: 7/28/95
Time: 1625

Received
Signature:
Print Name:
Company:
Date:
Time:

Relinquished
Signature:
Print Name:
Company:
Date:
Time:

Received
Signature:
Print Name: Doug McKenzie
Company: OAL
Date: 7/28/95
Time: 4:25P

Shipped Via: Hand delivered
Received @ 4 °C
Appropriate Containers ☒ Yes ☐ No

- X 4oz. (8oz.) Jars
- ____ VOA Vials
- ____ Plastic Bottles
- ____ Glass Bottles
- ____ other

OAL

CENTURY WEST ENGINEERING
825 NE MULTNOMAH, SUITE 425
PORTLAND, OR 97232

ANALYST REVIEW BY: RJ DATE: 8/7/95
DATA PACK REVIEW BY: KMB DATE: 8/7/95

ALICE LARSEN
231-6078FAX 231-6482
R001322/40038-101-01

HYDROCARBON IDENTIFICATION (HCID)
BY OREGON DEQ TPH-HCID

SAMPLE ID:	S-4A	S-4B	S-4C	S-4D	S-4E
OAL ID: 25-I687-	39428	39429	39430	39431	39432
SAMPLE DATE:	7/31/95	7/31/95	7/31/95	7/31/95	7/31/95
MATRIX:	SOIL	SOIL	SOIL	SOIL	SOIL
EXTRACTION DATE:	8/3/95	8/1/95	8/1/95	8/1/95	8/1/95
ANALYSIS DATE:	8/3/95	8/2/95	8/2/95	8/2/95	8/2/95
HCID:	ND	ND	ND	ND	ND
HCID(CONTINUED):	.	.	.	.	.
SURR.RECOVERY %	109.	116.	115.	112.	111.
ANALYST:	RJ	RJ	RJ	RJ	RJ

ORTHO-TERPHENYL WAS USED AS THE SURROGATE
NA = NOT ANALYZED
GASOLINE REGION (C6 THRU C10)
DIESEL REGION (C10 THRU C28)
OIL AND BUNKER C REGION (BEYOND C28)
ND = NONE DETECTED (GASOLINE < 20 MG/KG, DIESEL < 50 MG/KG)
MI = MATRIX INTERFERENCE WITH SURROGATE RECOVERY

OREGON ANALYTICAL LABORATORY
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Beaverton, OR 97007
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OAL

CENTURY WEST ENGINEERING
825 NE MULTNOMAH, SUITE 425
PORTLAND, OR 97232

ANALYST REVIEW BY: RJ DATE: 8/7/95

DATA PACK REVIEW BY: KMB DATE: 8/7/95

ALICE LARSEN
231-6078FAX 231-6482
R001322/40038-101-01

HYDROCARBON IDENTIFICATION (HCID)
BY OREGON DEQ TPH-HCID

SAMPLE ID:	S-4Z
OAL ID: 25-I687-	39433
SAMPLE DATE:	7/31/95
MATRIX:	SOIL
EXTRACTION DATE:	8/1/95
ANALYSIS DATE:	8/2/95
HCID:	ND
HCID(CONTINUED):	.
SURR.RECOVERY %	109.
ANALYST:	RJ

ORTHO-TERPHENYL WAS USED AS THE SURROGATE
NA = NOT ANALYZED
GASOLINE REGION (C6 THRU C10)
DIESEL REGION (C10 THRU C28)
OIL AND BUNKER C REGION (BEYOND C28)
ND = NONE DETECTED (GASOLINE < 20 MG/KG, DIESEL < 50 MG/KG)
MI = MATRIX INTERFERENCE WITH SURROGATE RECOVERY

OREGON ANALYTICAL LABORATORY
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Beaverton, OR 97007
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OAL

CENTURY WEST ENGINEERING
825 NE MULTNOMAH, SUITE 425
PORTLAND, OR 97232

ANALYST REVIEW BY: [signature] DATE: 8/11/95

DATA PACK REVIEW BY: NB DATE: 8/11/95

ALICE LARSEN
231-6078FAX 231-6482
R001322/40038-101-01

TOTAL METALS
EPA METHODS 6010 AND 7470

SAMPLE ID:		S-4A	S-4B	S-4C	S-4D	S-4E
OAL ID: 25-I687-		39434	39435	39436	39437	39438
SAMPLE DATE:		7/31/95	7/31/95	7/31/95	7/31/95	7/31/95
DIGESTION DATE:		8/3/95	8/3/95	8/3/95	8/3/95	8/3/95
ARSENIC	PPM	1.5	1.7	1.6	1.5	1.4
BARIUM	PPM	55.2	59.8	49.7	49.4	56.4
CADMIUM	PPM	<0.2	<0.2	<0.2	<0.2	<0.2
CHROMIUM	PPM	10.6	11.8	12.1	8.88	13.8
LEAD	PPM	<2.5	<2.5	<2.5	<2.5	3.2
MERCURY	PPM	<0.02	<0.02	<0.02	<0.02	<0.02
SELENIUM	PPM	<5.0	<5.0	<5.0	<5.0	<5.0
SILVER	PPM	<0.3	<0.3	<0.3	<0.3	<0.3

NA = NOT ANALYZED

OREGON ANALYTICAL LABORATORY

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14855 S.W. Old Scholls Ferry Road

Beaverton, OR 97007

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OAL

CENTURY WEST ENGINEERING
825 NE MULTNOMAH, SUITE 425
PORTLAND, OR 97232

ANALYST REVIEW BY: TWWellington DATE: 8/11/95

DATA PACK REVIEW BY: NB DATE: 8/11/95

ALICE LARSEN
231-6078FAX 231-6482
R001322/40038-101-01

TOTAL METALS
EPA METHODS 6010 AND 7470

SAMPLE ID:		S-4Z
OAL ID: 25-I687-		39439
SAMPLE DATE:		7/31/95
DIGESTION DATE:		8/3/95
ARSENIC	PPM	1.5
BARIUM	PPM	50.4
CADMIUM	PPM	<0.2
CHROMIUM	PPM	9.75
LEAD	PPM	<2.5
MERCURY	PPM	<0.02
SELENIUM	PPM	<5.0
SILVER	PPM	<0.3

NA = NOT ANALYZED

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Beaverton, OR 97007
Phone 503-590-5300 • Fax 503-590-1404

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1485 Old [illegible] Ferry Rd.
Beaverton, Oregon 97007
(503) 590-5300
FAX (503) 590-1404

CHAIN OF CUSTODY RECORD
LABORATORY ANALYSIS REQUEST

Client Information

Company: Century West
Contact: Alice Larsen
Address: 825 NE Multnomah Ste. 925, PDX 97232
Phone #: 231-6078 FAX #: 231-6842

Project Name: Port - Surcharge Sampling
Project Number: 40038-101-01
P.O. Number:
Comments: BILL PORT ATTN PAD QUINN

Sampler's Name: Alice Larsen
Signature:
Sampling Date: 7/31/95

Provide Verbal Results: ☒ Yes ☐ No
Provide FAX Results: ☒ Yes ☐ No

	Sample Identification	Date	Time	OAL #	# of Containers	Matrix: Soil	Matrix: Water	Matrix: Other (Note in Remarks)	Analyses: TPH HCID 25. I687.	Analyses: TPH-HCID QuantifY? Yes/No	Analyses: Dissolved Metals Est. 8 Total	Turnaround: 25 Remarks
1	S-4A	7/31/95		39428	2	X			X	X	X	39434 I687 metals
2	S-4B			39429	2				X	X	X	39435
3	S-4C			39430	1				X	X	X	39436
4	S-4D			39431	2				X	X	X	39437
5	S-4E			39432	2				X	X	X	39438
6	S-4Z			39433	1				X	X	X	39439
7												
8												
9												
10												

Analyses: Volatiles 624/8260 (circle) All Aromatic Halogenated; Semivolatiles 625/8270 (circle) All PAH(SIM) Phenol Phthalate; Organochlorinateds 608/8080 All PCB Pesticide (circle); Chlorinated Herbicides 8150; TPH Quantification (circle) G D 418.1M 418.1; BTEX 602/8020; TCLP Metals (circle) As Ba Cd Cr Pb Hg Se Ag; TCLP Organics (circle) Vol Semivol Pest Herb

Turnaround: N - 2 weeks; S - 1 week; R - Rush; O - Other

Relinquished
Signature:
Print Name: Alice J Larsen
Company: Century West
Date: 7/31/95
Time:

Received
Signature:
Print Name:
Company:
Date:
Time:

Relinquished
Signature:
Print Name:
Company:
Date:
Time:

Received
Signature:
Print Name: Doug McKenzie
Company: OAL
Date: 7/31/95
Time: 12:15P

Shipped Via: Hand Delivered
Received @ 4 °C
Appropriate Containers: ☒ Yes ☐ No

X 4oz./8oz. Jars
____ VOA Vials
____ Plastic Bottles
____ Glass Bottles
____ other

OAL

CENTURY WEST ENGINEERING
825 NE MULTNOMAH, SUITE 425
PORTLAND, OR 97232

ANALYST REVIEW BY: RJ DATE: 8/1/95

DATA PACK REVIEW BY: KMB DATE: 8/1/95

ALICE LARSEN
231-6078FAX 231-6482
R001322/40038-101-01

HYDROCARBON IDENTIFICATION (HCID)
BY OREGON DEQ TPH-HCID

SAMPLE ID:	S-6A	S-6B	S-5A	S-5B	S-3A
OAL ID: 25-I687-	39248	39249	39250	39251	39252
SAMPLE DATE:	7/26/95	7/26/95	7/26/95	7/26/95	7/26/95
MATRIX:	SOIL	SOIL	SOIL	SOIL	SOIL
EXTRACTION DATE:	7/28/95	7/28/95	7/28/95	7/28/95	7/28/95
ANALYSIS DATE:	7/30/95	7/30/95	7/30/95	7/30/95	7/30/95
HCID:	ND	ND	ND	ND	ND
HCID(CONTINUED):	.	.	.	.	.
SURR.RECOVERY %	114.	110.	111.	108.	114.
ANALYST:	RJ	RJ	RJ	RJ	RJ

ORTHO-TERPHENYL WAS USED AS THE SURROGATE
NA = NOT ANALYZED
GASOLINE REGION (C6 THRU C10)
DIESEL REGION (C10 THRU C28)
OIL AND BUNKER C REGION (BEYOND C28)
ND = NONE DETECTED (GASOLINE < 20 MG/KG, DIESEL < 50 MG/KG)
MI = MATRIX INTERFERENCE WITH SURROGATE RECOVERY

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CENTURY WEST ENGINEERING
825 NE MULTNOMAH, SUITE 425
PORTLAND, OR 97232

ANALYST REVIEW BY: RJ DATE: 8/1/95

DATA PACK REVIEW BY: JP DATE: 8/1/95

ALICE LARSEN
231-6078FAX 231-6482
R001322/40038-101-01

HYDROCARBON IDENTIFICATION (HCID)
BY OREGON DEQ TPH-HCID

SAMPLE ID:	S-3B	S-3C	S-3D	S-3E	S-3F
OAL ID: 25-I687-	39253	39254	39255	39256	39257
SAMPLE DATE:	7/26/95	7/26/95	7/26/95	7/26/95	7/26/95
MATRIX:	SOIL	SOIL	SOIL	SOIL	SOIL
EXTRACTION DATE:	7/28/95	7/28/95	7/28/95	7/28/95	7/28/95
ANALYSIS DATE:	7/30/95	7/30/95	7/30/95	7/30/95	7/30/95
HCID:	ND	ND	ND	ND	ND
HCID(CONTINUED):	.	.	.	.	.
SURR.RECOVERY %	103.	109.	122.	109.	125.
ANALYST:	RJ	RJ	RJ	RJ	RJ

ORTHO-TERPHENYL WAS USED AS THE SURROGATE
NA = NOT ANALYZED
GASOLINE REGION (C6 THRU C10)
DIESEL REGION (C10 THRU C28)
OIL AND BUNKER C REGION (BEYOND C28)
ND = NONE DETECTED (GASOLINE < 20 MG/KG, DIESEL < 50 MG/KG)
MI = MATRIX INTERFERENCE WITH SURROGATE RECOVERY

OREGON ANALYTICAL LABORATORY
A Division of Portland General Electric
14855 S.W. Old Scholls Ferry Road
Beaverton, OR 97007
Phone 503-590-5300 • Fax 503-590-1404

OAL

CENTURY WEST ENGINEERING
825 NE MULTNOMAH, SUITE 425
PORTLAND, OR 97232

ANALYST REVIEW BY: TMW DATE: 8/11/95

DATA PACK REVIEW BY: NB DATE: 8/11/95

ALICE LARSEN
231-6078FAX 231-6482
R001322/40038-101-01

TOTAL METALS
EPA METHODS 6010 AND 7470

SAMPLE ID:		S-6A	S-6B	S-5A	S-5B	S-3A
OAL ID: 25-I687-		39258	39259	39260	39261	39262
SAMPLE DATE:		7/26/95	7/26/95	7/26/95	7/26/95	7/26/95
DIGESTION DATE:		7/31/95	7/31/95	7/31/95	7/31/95	7/31/95
ARSENIC	PPM	1.8	1.0	1.5	1.3	4.00
BARIUM	PPM	43.1	90.8	65.9	83.8	79.8
CADMIUM	PPM	<0.2	<0.2	<0.2	<0.2	<0.2
CHROMIUM	PPM	10.3	13.6	13.7	22.0	17.2
LEAD	PPM	3.5	5.0	3.3	4.0	5.6
MERCURY	PPM	0.020	0.023	<0.02	0.022	0.021
SELENIUM	PPM	<5.0	<5.0	<5.0	<5.0	<5.0
SILVER	PPM	<0.3	<0.3	<0.3	<0.3	<0.3

NA = NOT ANALYZED

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Beaverton, OR 97007
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OAL

CENTURY WEST ENGINEERING
825 NE MULTNOMAH, SUITE 425
PORTLAND, OR 97232

ANALYST REVIEW BY: 8/11/95 TDW DATE: 8/11/95

DATA PACK REVIEW BY: NB DATE: 8/11/95

ALICE LARSEN
231-6078FAX 231-6482
R001322/40038-101-01

TOTAL METALS
EPA METHODS 6010 AND 7470

SAMPLE ID:		S-3B	S-3C	S-3D	S-3E	S-3F
OAL ID: 25-I687-		39263	39264	39265	39266	39267
SAMPLE DATE:		7/26/95	7/26/95	7/26/95	7/26/95	7/26/95
DIGESTION DATE:		7/31/95	7/31/95	7/31/95	7/31/95	7/31/95
ARSENIC	PPM	3.65	2.9	2.9	3.2	3.97
BARIUM	PPM	69.7	71.2	54.5	80.8	83.8
CADMIUM	PPM	<0.2	<0.2	<0.2	<0.2	<0.2
CHROMIUM	PPM	17.5	11.8	11.8	13.4	18.0
LEAD	PPM	6.4	5.3	2.7	5.9	6.0
MERCURY	PPM	0.021	0.023	0.021	0.036	0.023
SELENIUM	PPM	<5.0	<5.0	<5.0	<5.0	<5.0
SILVER	PPM	<0.3	<0.3	<0.3	<0.3	<0.3

NA = NOT ANALYZED

OREGON ANALYTICAL LABORATORY
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OAL Analytical Laboratory
Beaverton, Oregon 97007
(503) 690-5300
FAX (503) 690-1404

LABORATORY ANALYSIS REQUEST

Page 1 of ___

Client Information

Company: Century West
Contact: Alice Larsen
Address: 825 NE Multnomah Ste 425, PDX, OR 97232
Phone #: 231 6078 FAX #: 231 6482

Project Name: Part - Surchange Sampling
Project Number: 40638-101-01
P.O. Number:
Comments: BILL PORT DIRECTLY

Sampler's Name: Alice Larsen
Signature:
Sampling Date: 7/26/95

Provide Verbal Results: ☒ Yes ☐ No
Provide FAX Results: ☒ Yes ☐ No

	Sample Identification	Date	Time	HCID OAL # 25.1687.	# of Containers	Matrix: Soil	Matrix: Water	Matrix: Other (Note in Remarks)	Analyses	Turnaround	Remarks
1	S-6A	7/26/95		39248	2				TPH-HCID OR-DEQ Quantify? Yes; Metals ☐Dissolved ☒Total In RCRA 8		Metals 39258
2	S-6B			39249	2				TPH-HCID OR-DEQ Quantify? Yes; Metals ☐Dissolved ☒Total In RCRA 8		39259
3	S-5A			39250	2				TPH-HCID OR-DEQ Quantify? Yes; Metals ☐Dissolved ☒Total In RCRA 8		39260
4	S-5B			39251	2				TPH-HCID OR-DEQ Quantify? Yes; Metals ☐Dissolved ☒Total In RCRA 8		39261
5	S-3A			39252	2				TPH-HCID OR-DEQ Quantify? Yes; Metals ☐Dissolved ☒Total In RCRA 8		39262
6	S-3B			39253	2				TPH-HCID OR-DEQ Quantify? Yes; Metals ☐Dissolved ☒Total In RCRA 8		39263
7	S-3C			39254	1				TPH-HCID OR-DEQ Quantify? Yes; Metals ☐Dissolved ☒Total In RCRA 8		39264
8	S-3D			39255	2				TPH-HCID OR-DEQ Quantify? Yes; Metals ☐Dissolved ☒Total In RCRA 8		39265
9	S-3E			39256	2				TPH-HCID OR-DEQ Quantify? Yes; Metals ☐Dissolved ☒Total In RCRA 8		39266
10	S-3F			39257	2				TPH-HCID OR-DEQ Quantify? Yes; Metals ☐Dissolved ☒Total In RCRA 8		39267

Turnaround: N - 2 weeks; S - 1 week; R - Rush; O - Other ___

Relinquished
Signature:
Print Name: Alice J Larsen
Company: Century West
Date: 7-27-95
Time: 9:50

Received
Signature:
Print Name:
Company: OAL
Date: 7-27-95
Time: 9:51

Relinquished
Signature:
Print Name:
Company:
Date:
Time:

Received
Signature:
Print Name:
Company:
Date:
Time:

Shipped Via: Hand
Received @ 4 °C
Appropriate Containers ☒ Yes ☐ No

19 4oz. (8oz) Jars
___ VOA Vials
___ Plastic Bottles
___ Glass Bottles
___ other ___

Attachment E
1995 Transformer Spill Cleanup
Port of Portland Terminal 5

TERMINAL 5 TRANSFORMER SPILL CLEANUP

Terminal 5 - N Lombard Street
Portland, Oregon

Prepared for:
Port of Portland
PO Box 3529
Portland, Oregon 97208

Prepared by:

CENTURY WEST ENGINEERING CORPORATION

Thomas B. Gainer, P.E.
Senior Environmental Engineer

Alice J. Larsen
Project Engineer

August 30, 1995

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EXECUTIVE SUMMARY

TERMINAL 5 TRANSFORMER SPILL CLEANUP
Port of Portland
Terminal 5, N Lombard Street
Portland, Oregon

On May 30, 1995, vandalism/theft reportedly caused the loss of 200 to 300 gallons of mineral oil from a 2,200 gallon transformer located in the southwest quadrant of Terminal 5. A sample of the oil was obtained from the transformer by CET Environmental and submitted for analysis for polychlorinated biphenyls (PCBs). It was reported to Century West Engineering Corporation (Century West) that PCBs were not detected in the transformer oil. A small, older spill, located east of the transformer spill, was also noted.

The transformer and associated circuit box were removed May 31, 1995, by Morgan Machinery Moving & Rigging under separate contract with the Port of Portland. Century West obtained soil and groundwater samples during and following cleanup activities. The cleanup activities included excavation of approximately 25 cubic yards of impacted soil and evacuation of approximately 1,200 gallons of groundwater from the excavation. Groundwater was encountered at 3 feet below ground surface (bgs).

Soil samples were collected from the bottom of the excavation during the cleanup activities and from the sidewalls at the original soil/water interface following excavation. The small, older spill area was excavated and a soil sample was obtained from the bottom of the excavation at 2 feet bgs. The soil samples were submitted for analysis for total petroleum hydrocarbons (TPH) using EPA Method 418.1 Modified. Analytical test results revealed 20 parts per million (ppm) or less in all soil samples.

A groundwater sample was collected as soon as practicable following the evacuation of 1,200 gallons of water from the excavation. The water sample was submitted for analysis for TPH using EPA Method 418.1. Analytical test results revealed 2 ppm TPH in the water, therefore, analysis was also performed for polynuclear aromatic hydrocarbons (PAHs) using EPA Method 8270. Analytical test results revealed non-carcinogenic PAHs up to 2.2 parts per billion (ppb). No carcinogenic PAHs were detected.

The cleanup activities, including soil excavation and groundwater pumping, were performed in a timely manner following the release. Analytical test results, compared with cleanup levels for petroleum sites associated with USTs, indicate that cleanup is complete. Century West recommends no further action regarding the transformer oil release at Terminal 5.

TERMINAL 5 TRANSFORMER SPILL CLEANUP
Port of Portland
Terminal 5, N Lombard Street
Portland, Oregon

1.0 INTRODUCTION

Century West Engineering Corporation (Century West) was retained by the Port of Portland to oversee cleanup activities at Terminal 5, located on N Lombard in Portland, Oregon. This report presents our activities and findings associated with the May 30, 1995, transformer oil spill at Terminal 5. Vandalism/theft reportedly caused the loss of 200 to 300 gallons of mineral oil from a 2,200 gallon transformer located in the southwest quadrant of Terminal 5 (Figure 1 and Appendix C, Photograph 1). A sample of the oil was obtained from the transformer by CET Environmental and submitted for analysis for polychlorinated biphenyls (PCBs). It was reported to Century West that PCBs were not detected in the transformer oil. A small, older spill, located east of the transformer spill, was also remediated (Appendix C, Photograph 2).

2.0 SITE ACTIVITIES

The transformer and associated circuit box were removed May 31, 1995, by Morgan Machinery Moving & Rigging under separate contract with the Port of Portland. Century West arrived on the site on June 1, 1995, to provide oversight for the cleanup activities. Century West obtained soil and groundwater samples during and following cleanup activities. The cleanup activities included excavation of approximately 25 yards of impacted soil and evacuation of approximately 1,200 gallons of groundwater from the excavation.

2.1 Excavation of Contaminated Soil

Approximately 25 cubic yards of contaminated soil was excavated from under the former transformer and circuit box on June 1, 1995. The excavated soil was placed on and covered by plastic near the excavation site. The excavation work was performed by CET Environmental, Inc., under separate contract with the Port of Portland. Soils consisted of fine to medium sand (fill) over native silty sand. Groundwater was encountered between 3 and 3.5 feet below ground surface (bgs), where the native soil begins (Appendix C, Photograph 3). Yellow foam and orange oil were observed on the

groundwater during the excavation activities (Appendix C, Photograph 4). The extent of the excavation is shown on Figure 2, and was based on removal of visibly stained soil.

2.2 Soil Sampling

During soil sample collection, a reference north direction was established and the soil samples were labeled accordingly. The reference north direction chosen in the field is 90 degrees off the actual north direction and is shown on Figure 2. Soil samples INTFACN4 and INTFACS3.5 were obtained from the bottom of the excavation, below the groundwater table. These soil samples were obtained by blocking the groundwater with a semi-earth dam and obtaining a backhoe bucket full of the native silty sand before the groundwater seeped back in. Soil samples SWN3, SWW3.5, SWE3, and SWS3 were obtained from the sidewalls of the excavation at the original soil/water interface. The soil sample identification indicates which sidewall (using the reference north) and at what depth in feet the soil sample was obtained. Soil sample SWCORSW3 was obtained from the southwest corner sidewall at 3 feet bgs.

An older, small spill was noted near the transformer. A separate excavation was performed to two feet bgs at that location (Figure 2). Soil sample OTHOL was obtained from the bottom of excavation at 2 feet bgs.

2.3 Groundwater Pumping

On June 1, 1995, approximately 250 gallons of groundwater was pumped from the excavation and into a temporary holding tank. On June 2, 1995, approximately 950 gallons of groundwater was pumped from the excavation and into temporary holding tanks (Appendix C, Photographs 5 and 6). The pumping effort was steady for 5 hours. A final recharge water sample (EX-W1) was obtained from the excavation as soon as practicable following the June 2, 1995 pumping (Appendix C, Photograph 7).

2.4 Disposal of Excavated Soil and Pumped Water

The excavation was backfilled with 29.2 tons of imported fill from Pacific Rock Products in Vancouver, Washington and 5 cubic yards of imported fill from Angell Bros., Inc., in Portland, Oregon. Receipts from the rock companies are included in Appendix B.

On August 14, 1995, the excavated and stockpiled soil (Appendix C, Photograph 8) was transported to Oregon Hydrocarbon, Inc., in Portland, Oregon for treatment by thermal desorption. The total amount of soil delivered to OHI was 31 tons. The trip tickets are included in Appendix B.

On August 11, 1995, the water that was pumped from the excavation and stored in 250-gallon totes was transported to Harbor Oil for recycling. The receipt from Harbor Oil is included in Appendix B.

3.0 ANALYTICAL LABORATORY ANALYSIS AND RESULTS

The soil samples were submitted to Oregon Analytical Laboratory in Beaverton, Oregon, for analysis for total petroleum hydrocarbons (TPH) using EPA Method 418.1 Modified. The water sample was submitted for analysis for TPH using EPA Method 418.1 and for polynuclear aromatic hydrocarbons (PAHs) using EPA Method 8270 Modified.

Total petroleum hydrocarbons detected in the soil samples ranged from less than 3 ppm to 20 ppm. These levels are well below the most conservative soil cleanup level of 100 ppm (for diesel) provided under the Oregon Department of Environmental Quality Soil Matrix Rules (OAR 340-122-220 to 360) for underground storage tanks (USTs). Although this release was not from an UST, the Soil Matrix Rules can still serve as a guidance and are referred to in the Soil Cleanup Manual (OAR 340-11-045 and -046) for a petroleum release. Table 1 summarizes the analytical test results. Analytical laboratory reports are included as Appendix A.

TABLE 1

ANALYTICAL TEST RESULTS
SOIL SAMPLES
TERMINAL 5 - TRANSFORMER OIL SPILL

Sample Identification	Sample Location/Depth in Feet	Concentration in ppm (TPH 418.1 Modified)
INTFACN4	Bottom/4'	19
INTFACS3.5	Bottom/3.5'	<3
SWW3.5	West Sidewall/3.5'	5
SWN3	North Sidewall/3'	4
SWE3	East Sidewall/3'	<3
SWS3	South Sidewall/3'	7
SWCORSW3	Southwest Corner Sidewall/3'	5
OTHOL	Other Excavation/2'	20

Notes: Soil samples collected June 1, 1995
ppm - parts per million (mg/kg)
'<' - less than
TPH - total petroleum hydrocarbons
Soil Matrix Cleanup Level for Diesel (most conservative) - 100 ppm

Total petroleum hydrocarbons were detected at 2 ppm in groundwater sample EX-W1. Non-carcinogenic PAHs were detected at low concentrations. Using the UST Cleanup Rules as a guideline, the concentrations of the detected PAHs are well below cleanup levels. Table 2 summarizes the analytical test results and compares them with the cleanup levels discussed above.

TABLE 2

ANALYTICAL TEST RESULTS
GROUNDWATER SAMPLE
TERMINAL 5 - TRANSFORMER OIL SPILL CLEANUP

Compound	Sample EX-W1	UST Cleanup Levels
Total Petroleum Hydrocarbons	2 ppm	If detected, run PAHs
Naphthalene	<0.1 ppb	28 ppb
Acenaphthylene	<0.1 ppb	Not Listed
Acenaphthene	0.2 ppb	420 ppb
Fluorene	0.8 ppb	280 ppb
Phenanthrene	2.2 ppb	Not Listed
Anthracene	0.2 ppb	2,100 ppb
Fluoranthene	0.3 ppb	280 ppb
Pyrene	0.2 ppb	210 ppb
Benzo(a)anthracene*	<0.1 ppb	0.1 ppb
Chrysene*	<0.1 ppb	0.2 ppb
Benzo(b)fluoranthene*	<0.1 ppb	0.2 ppb
Benzo(k)fluoranthene*	<0.1 ppb	0.2 ppb
Benzo(a)pyrene*	<0.1 ppb	0.2 ppb
Indeno(1,2,3-cd)pyrene*	<0.1 ppb	0.4 ppb
Dibenz(a,h)anthracene*	<0.1 ppb	0.3 ppb
Benzo(g,h,i)perylene	<0.1 ppb	Not Listed

Notes: Groundwater Sample Collected on June 2, 1995
ppm - parts per million (mg/l)
ppb - parts per billion (μg/l)
'<' - less than
Compounds listed with an "*" are carcinogenic PAHs

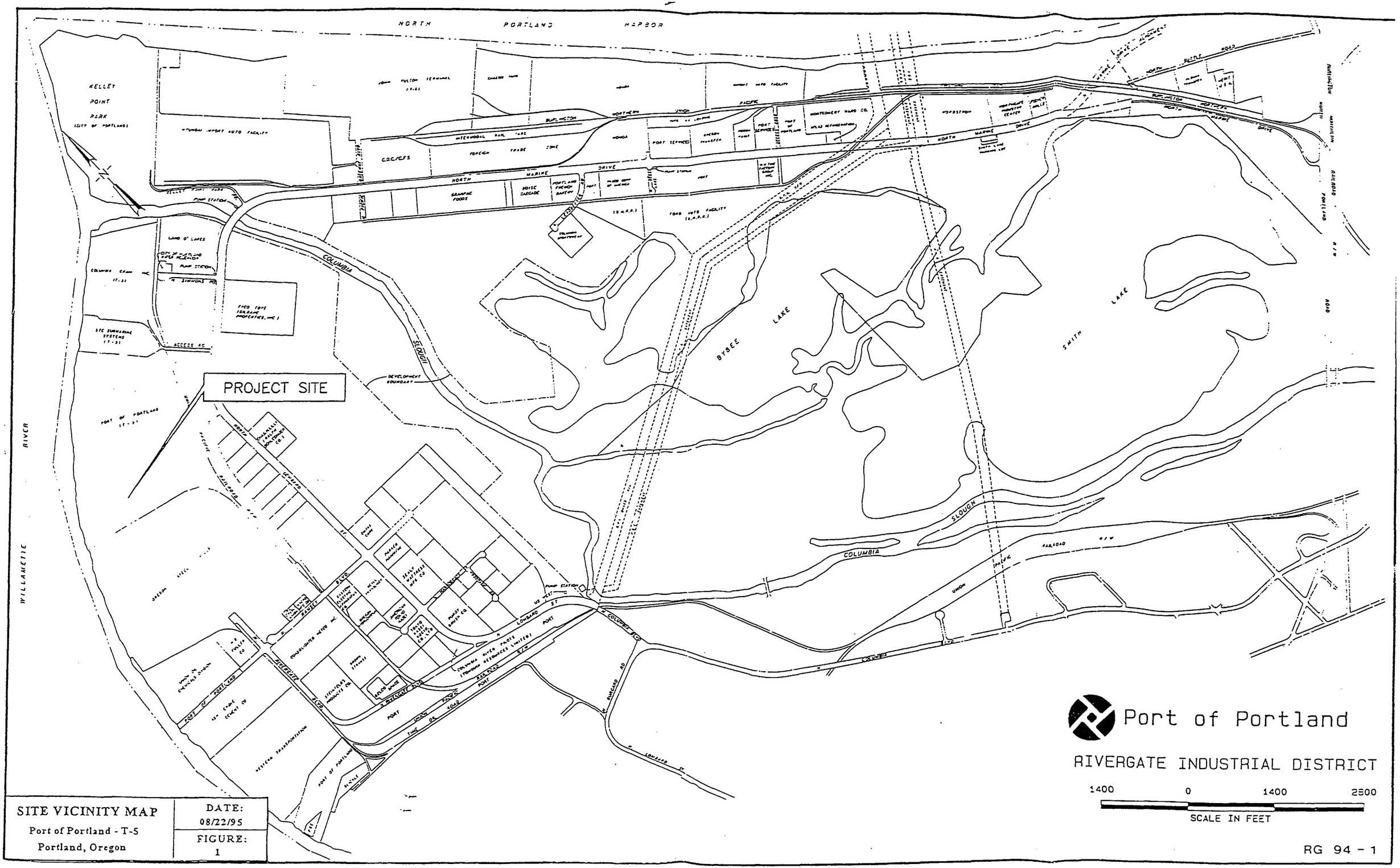
4.0 CONCLUSIONS AND RECOMMENDATION

Approximately 25 cubic yards of impacted soil was excavated as a result of a non-PCB transformer oil spill that occurred as a result of vandalism/theft. It was estimated that 200 to 300 gallons of oil was released. Groundwater was encountered in the excavation at a depth of 3 feet bgs. Approximately 1,200 gallons of groundwater was pumped from the excavation and into temporary holding tanks. The soil was transported to Oregon Hydrocarbon, Inc., for treatment by thermal desorption and the water was transported to Harbor Oil for recycling.

Soil and groundwater samples were collected following the cleanup activities. Analytical test results for the verification soil samples ranged from below the detection limit to 20 ppm. Although this is not an underground storage tank (UST) site, the Oregon DEQ Soil Cleanup Manual directs TPH cleanups to the Leaking UST Cleanup Rules (OAR 340-122-220 to 360). Although these rules do not directly apply to a site where groundwater is encountered, they can serve as a guideline to address the soil cleanup portion of this project. According to the UST Cleanup Rules, the most conservative cleanup level for diesel or heavier oils is 100 ppm. This cleanup level is five-fold the highest TPH concentration detected in the verification soil samples, indicating a successful soil cleanup.

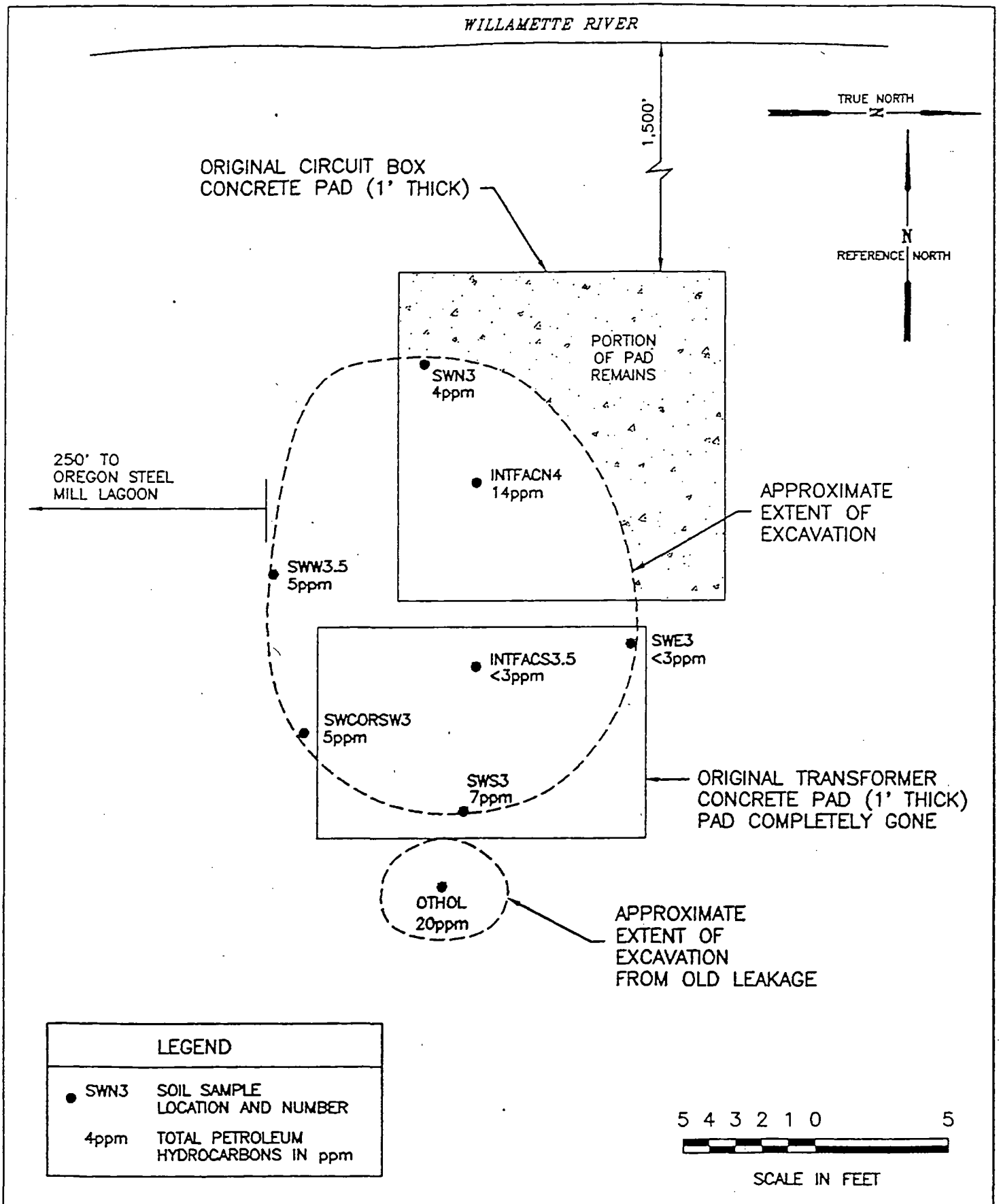
The groundwater sample was submitted for analysis for TPH and, due to the detection of 2 ppm TPH, for PAHs. As with the soil test results, the Leaking UST Cleanup Rules include cleanup levels for PAHs in the groundwater (OAR 340-122-242). Cleanup levels for carcinogenic PAHs are much more conservative than for non-carcinogenic PAHs. No carcinogenic PAHs were detected in the groundwater sample collected following cleanup activities. Non-carcinogenic PAHs were detected at concentrations below cleanup levels established for leaking USTs, indicating a successful groundwater cleanup.

The cleanup activities, including soil excavation and groundwater pumping, were performed in a timely manner following the release. Analytical test results, compared with cleanup levels for petroleum sites associated with USTs, indicated that cleanup is complete. Century West recommends no further action regarding the transformer oil release at Terminal 5.



SITE VICINITY MAP	DATE: 08/22/95
Port of Portland - T-5 Portland, Oregon	FIGURE: 1

RG 94 - 1



DESIGNED BY: AJL	CHECKED BY:	EXCAVATION AND SAMPLING LOCATIONS	DATE: 06/13/95
DRAWN BY: DMC	SCALE: 1"=5'	PORT OF PORTLAND – T-5 PORTLAND, OREGON	FIGURE: 2
FILE: 40038008\01\3F1FIG3		centurywest ENGINEERING CORPORATION	

APPENDIX A

ANALYTICAL LABORATORY REPORTS

OAL

PORT OF PORTLAND
P.O. BOX 3529
PORTLAND, ORE. 97208

ANALYST REVIEW BY: D Miller DATE: 6/8/95

DATA PACK REVIEW BY: SL DATE: 6/8/95

(503) 231-5000X710
PROJ. NAME: TERMINAL 5 SPILL

POLYNUCLEAR AROMATIC HYDROCARBONS (PAH)
BY EPA METHOD 625/8270

SAMPLE ID:	EX-W1
OAL ID: 25-0178-	37466
SAMPLE DATE:	6/2/95
MATRIX:	WATER
EXTRACTION DATE:	6/7/95
ANALYSIS DATE:	6/7/95
RESULTS:	ATTACHED
ANALYST:	GC/DPH

NA = NOT ANALYZED

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OAL

PORT OF PORTLAND
P.O. BOX 3529
PORTLAND, OR 97208

EPA Method 8310 Polynuclear Aromatic Hydrocarbons by modified EPA Method 8270

Matrix:	Water	Matrix Blank	Detection Limit
Sample ID:	EX-W1		
OAL ID: 25-0178	37466	MB0607P	
Units:	µg/L	µg/L	µg/L
Naphthalene	ND	ND	0.1
Acenaphthylene	ND	ND	0.1
Acenaphthene	0.2	ND	0.1
Fluorene	0.8	ND	0.1
Phenanthrene	2.2	ND	0.1
Anthracene	0.2	ND	0.1
Fluoranthene	0.3	ND	0.1
Pyrene	0.2	ND	0.1
Benzo(a)anthracene	ND	ND	0.1
Chrysene	ND	ND	0.1
Benzo(b)fluoranthene	ND	ND	0.1
Benzo(k)fluoranthene	ND	ND	0.1
Benzo(a)pyrene	ND	ND	0.1
Indeno(1,2,3-cd)pyrene	ND	ND	0.1
Dibenz(a,h)anthracene	ND	ND	0.1
Benzo(g,h,i)perylene	ND	ND	0.1
Base/Neutral Surrogates:			
1,2-Dichlorobenzene-d4	103.%	104.%	
Nitrobenzene-d5	87.%	97.%	
2-Fluorobiphenyl	99.%	108.%	

ND = None Detected

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A Division of Portland General Electric
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Beaverton, OR 97007
Phone 503-590-5300 • Fax 503-590-1404

OAL

PORT OF PORTLAND
P.O. BOX 3529
PORTLAND, ORE. 97208

ANALYST REVIEW BY: RJ DATE: 6/8/95

DATA PACK REVIEW BY: SL DATE: 6/8/95

(503) 231-5000X710
PROJ. NAME: TERMINAL 5 SPILL

TOTAL PETROLEUM HYDROCARBONS (TPH) IN WATER BY EPA 418.1

SAMPLE ID:	EX-W1
OAL ID: 25-0178-	37466
SAMPLE DATE:	6/2/95
EXTRACTION DATE:	6/5/95
ANALYSIS DATE:	6/5/95
TPH IN MG/L	2.
ANALYST:	CC

NA = NOT ANALYZED
ND = NONE DETECTED (REPORTING LIMIT IS 0.5 MG/L)

OREGON ANALYTICAL LABORATORY
A Division of Portland General Electric
14855 S.W. Old Scholls Ferry Road
Beaverton, OR 97007
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CENTURY TESTING LABORATORIES

1444 NW College Way / Bend, Oregon 97701
(503) 382-6432 / (800) 458-9672 / Fax: (503) 388-5062

CHAIN OF CUSTODY RECORD

Log in for 0178

Bill Port of Portland Directly

1. PROJ. NO.	2. PROJECT NAME & ADDRESS: T-5 Transf. Spill, Terminal 5, Portland, OR						10. NO. OF CONTAINERS	11. ANALYSIS TO BE PERFORMED: TPH 418.1M; TPH 418.1; BTEX; GAL; LAB SAMPLE NO.	12. REMARKS
3. SAMPLERS: (SIGNATURE) Alice Larsen									
4. BTA. NO. 25-0178	5. DATE	6. TIME	7. COMPOSITE	8. GRAB	9. STATION LOCATION	MATRIX			
37458	6/1/95	1630		X	SWS3	Soil	1	X	ALL RUSH
37459	6/1/95	1620		X	SWW3.5	Soil	1	X	
37460	6/1/95	1635		X	SWE3	Soil	1	X	
37461	6/1/95	1230		X	INTFACN4	Soil	1	X	
37462	6/1/95	1495		X	INTFACS3.5	Soil	1	X	
37463	6/1/95	1625		X	SWCORSW3	Soil	1	X	
37464	6/1/95	1615		X	SWN3	Soil	1	X	
[redacted]	6/2/95	1515		X	[redacted]	Water	4	X	Hold 6 Vials For PAH / BTEX
37465	6/1/95	1650		X	OTHOL	Soil	1	X	
									Special Remark Send copy of Report to Century Testing

13. RELINQUISHED BY: (SIGNATURE)	14. DATE/TIME	15. RECEIVED BY: (SIGNATURE)	13. RELINQUISHED BY: (SIGNATURE)	14. DATE/TIME	15. RECEIVED BY: (SIGNATURE)
Alice Larsen	6/2/95 5:12	[illegible]			ph#231-6078 Alice fx#231-6482 Larsen
13. RELINQUISHED BY: (SIGNATURE)	14. DATE/TIME	15. RECEIVED BY: (SIGNATURE)	13. RELINQUISHED BY: (SIGNATURE)	14. DATE/TIME	15. RECEIVED BY (SIGNATURE)
13. RELINQUISHED BY: (SIGNATURE)	14. DATE/TIME	15. RECEIVED FOR LABORATORY BY:	17. DATE/TIME	18. REMARKS	

OAL

PORT OF PORTLAND
P.O. BOX 3529
PORTLAND, ORE. 97208

ANALYST REVIEW BY: RJ DATE: 6/5/95

DATA PACK REVIEW BY: KMB DATE: 6/5/95

(503) 231-5000X710
PROJ. NAME: TERMINAL 5 SPILL

TOTAL PETROLEUM HYDROCARBONS (TPH)
BY OREGON DEQ TPH-418.1 MODIFIED

SAMPLE ID:	SWS3	SWW3.5	SWE3	INTFACN4	INTFACS3.5
OAL ID: 25-0178-	37458	37459	37460	37461	37462
SAMPLE DATE:	6/1/95	6/1/95	6/1/95	6/1/95	6/1/95
EXTRACTION DATE:	6/5/95	6/5/95	6/5/95	6/5/95	6/5/95
ANALYSIS DATE:	6/5/95	6/5/95	6/5/95	6/5/95	6/5/95
TPH IN MG/KG	7.	5.	ND	19.	ND
ANALYST:	GG	GG	GG	GG	GG

NA = NOT ANALYZED
ND = NONE DETECTED (<3 MG/KG)

OREGON ANALYTICAL LABORATORY
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OAL

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P.O. BOX 3529
PORTLAND, ORE. 97208

ANALYST REVIEW BY: RJ DATE: 6/5/95

DATA PACK REVIEW BY: KMB DATE: 6/5/95

(503) 231-5000X710
PROJ. NAME: TERMINAL 5 SPILL

TOTAL PETROLEUM HYDROCARBONS (TPH) IN WATER
BY EPA 418.1

SAMPLE ID:	EX-W1
OAL ID: 25-0178-	37466
SAMPLE DATE:	6/1/95
EXTRACTION DATE:	6/5/95
ANALYSIS DATE:	6/5/95
TPH IN MG/L	2.
ANALYST:	GG

NA = NOT ANALYZED
ND = NONE DETECTED (REPORTING LIMIT IS 0.5 MG/L)

OREGON ANALYTICAL LABORATORY
A Division of Portland General Electric
14855 S.W. Old Scholls Ferry Road
Beaverton, OR 97007
Phone 503-590-5300 • Fax 503-590-1404

OAL

PORT OF PORTLAND
P.O. BOX 3529
PORTLAND, ORE. 97208

ANALYST REVIEW BY: RJ DATE: 6/5/95

DATA PACK REVIEW BY: KMB DATE: 6/5/95

(503) 231-5000X710
PROJ. NAME: TERMINAL 5 SPILL

TOTAL PETROLEUM HYDROCARBONS (TPH)
BY OREGON DEQ TPH-418.1 MODIFIED

SAMPLE ID:	SWCORSW3	SWN3	OTHOL
OAL ID: 25-0178-	37463	37464	37465
SAMPLE DATE:	6/1/95	6/1/95	6/1/95
EXTRACTION DATE:	6/5/95	6/5/95	6/5/95
ANALYSIS DATE:	6/5/95	6/5/95	6/5/95
TPH IN MG/KG	5.	4.	20.
ANALYST:	GG	GG	GG

NA = NOT ANALYZED
ND = NONE DETECTED (<3 MG/KG)

OREGON ANALYTICAL LABORATORY
A Division of Portland General Electric
14855 S.W. Old Scholls Ferry Road
Beaverton, OR 97007
Phone 503-590-5300 • Fax 503-590-1404

OAL

PORT OF PORTLAND
P.O. BOX 3529
PORTLAND, ORE. 97208

ANALYST REVIEW BY: RJ DATE: 6/5/95

DATA PACK REVIEW BY: KMB DATE: 6/5/95

(503) 231-5000X710
PROJ. NAME: TERMINAL 5 SPILL

TOTAL PETROLEUM HYDROCARBONS (TPH) IN WATER
BY EPA 418.1

SAMPLE ID:	EX-W1
OAL ID: 25-0178-	37466
SAMPLE DATE:	6/1/95
EXTRACTION DATE:	6/5/95
ANALYSIS DATE:	6/5/95
TPH IN MG/L	2.
ANALYST:	GG

NA = NOT ANALYZED
ND = NONE DETECTED (REPORTING LIMIT IS 0.5 MG/L)

OREGON ANALYTICAL LABORATORY
A Division of Portland General Electric
14855 S.W. Old Scholls Ferry Road
Beaverton, OR 97007
Phone 503-590-5300 • Fax 503-590-1404

CENTURY TESTING LABORATORIES

CHAIN OF CUSTODY RECORD

1444 NW College Way / Bend, Oregon 97701
(503) 382-6432 / (800) 458-9672 / Fax: (503) 388-5062

Log in for 0178

Bill Port of Portland Directly

1. PROJ. NO.	2. PROJECT NAME & ADDRESS	10. NO. OF CONTAINERS	11. ANALYSIS TO BE PERFORMED: TPH 418.1M; TPH 9131; CAL LAB SAMPLE NO.	12. REMARKS
	T-5 Transf. Spill Terminal 5, Portland, OR			

3. SAMPLERS: (SIGNATURE)
Alice Larsen

4. STA. NO. 25-0178	5. DATE	6. TIME	7. COMPOSITE	8. GRAB	9. STATION LOCATION	MATRIX	10. NO. OF CONTAINERS	11. TPH 418.1M	11. TPH 9131	CAL LAB SAMPLE NO.	12. REMARKS
37458	6/1/95	1630		X	SWS3	Soil	1	X			ALL RUSH
37459	6/1/95	1620		X	SWW3.5	Soil	1	X			
37460	6/1/95	1635		X	SWE3	Soil	1	X			
37461	6/1/95	1230		X	INTFACN4	Soil	1	X			
37462	6/1/95	1445		X	INTFACS3.5	Soil	1	X			
37463	6/1/95	1625		X	SWCORSW3	Soil	1	X			
37464	6/1/95	1615		X	SWN3	Soil	1	X			
37466	6/2/95	1515		X	EX-W1	Water	4		X		Hold others for PAH / BTEX
37465	6/1/95	1650		X	OTHOL	Soil	1	X			
											Special Remark Send
											copy of Report to
											Century Testing

13. RELINQUISHED BY: (SIGNATURE)	14. DATE/TIME	15. RECEIVED BY: (SIGNATURE)	13. RELINQUISHED BY: (SIGNATURE)	14. DATE/TIME	15. RECEIVED BY: (SIGNATURE)
Alice Larsen	6/2/95 5:12	[illegible]			Ph #231-6078 Alice FX #231-6482 Larsen
13. RELINQUISHED BY: (SIGNATURE)	14. DATE/TIME	15. RECEIVED BY: (SIGNATURE)	13. RELINQUISHED BY: (SIGNATURE)	14. DATE/TIME	15. RECEIVED BY (SIGNATURE)
13. RELINQUISHED BY:	14. DATE/TIME	16. RECEIVED FOR LABORATORY BY:	17. DATE/TIME	18. REMARKS	

APPENDIX B

DISPOSAL AND IMPORTED FILL RECEIPTS

08-17-1995 04:32PM FROM CET Enviromental, PDX TO 2316482 P.02

TPS Technologies Soil Recycling
Non-Hazardous Soils

Manifest

Date of Shipment	Responsible for Payment	Transporter Truck #:			Load #
	GENERATOR	CET	09	01316	001

Generator's Name and Billing Address:
PORT OF PORTLAND
P.O. BOX 3529
PORTLAND, OR 97208

Generator's Phone #: ( ) -
Person to Contact: PADRAIC QUINN
FAX #: (503) 240-2009

Consultant's Name and Billing Address:
CENTURY WEST ENGINEERING
825 NE MULTNOMAH, SUITE 425
PORTLAND, OR 97232

Consultant's Phone #: (503) 231-6078
Person to Contact: ALICE LARSON
FAX #: ( ) -

Generation Site (Transport from):
PORT OF PORTLAND
TERMINAL 5 - RIVERGATE
PORTLAND, OR

Site Phone #: ( ) -
Person to Contact:
FAX #: ( ) -

ppb
16000F ppm
ppb ppm

Designated Facility (Transport to):
TPST SOIL RECYCLERS OF OREGON
9333 NORTH HARBORGATE STREET
PORTLAND, OR 97203

Facility Phone #: (503) 735-9525
Person to Contact: GLENNA MULLAN
FAX #: (503) 240-1712

Transporter Name and Mailing Address:

Transporter's Phone #: ( ) -
Person to Contact:
FAX #: ( ) -
Customer Account Number

Soil Type	Moisture Content	Contaminated by			Gross Weight	Tare Weight	Net Weight
Sand ☐ Organic ☐ Clay ☐ Other ☐	0-10% ☐ 10-20% ☐ 20%-over ☐	Gas ☐ Diesel ☐ Other ☐			26130	12180	13940
Sand ☐ Organic ☐ Clay ☐ Other ☐	0-10% ☐ 10-20% ☐ 20%-over ☐	Gas ☐ Diesel ☐ Other ☐				6.97	

List any exception to items listed above:

Generator's and/or consultant's certification: I/We certify that the soil referenced herein is taken entirely from those soils described in the Soil Data Sheet completed and certified by me/us for the Generation Site shown above and nothing has been added or done to such soil that would alter it in any way.

Print or Type Name: Generator ☐ Consultant ☐ Signature and date: Month Day Year

Transporter

Transporter's certification: I/We acknowledge receipt of the soil described above and certify that such soil is being delivered in exactly the same condition as when received. I/We further certify that this soil is being directly transported from the Generation Site to the Designated Facility without off-loading, adding to, subtracting from or in any way delaying delivery to such site.

Print or Type Name: Scott Gilfoan Signature and date: [signature] Month 8 Day 14 Year 95

Recycling Facility

Discrepancies:

Recycling Facility certifies the receipt of the soil covered by this manifest except as noted above:

Print or Type Name: Glenna Mullan Signature and date: [signature] 8-14-95

GENERATOR / CONSULTANT'S COPY

TPS Technologies Soil Recycling
Non-Hazardous Soils

Manifest # 1

Date of Shipment	Responsible for Shipment	Transporter Truck #			Load #
	GENERATOR	CET	09	01316	002

Generator's Name and Billing Address
PORT OF PORTLAND
P.O. BOX 3529
PORTLAND, OR 97208

( ) –
Person to Contact
PADRAIC QUINN
FAX (503) 240-2009

Consultant's Name and Billing Address
CENTURY WEST ENGINEERING
825 NE MULTNOMAH, SUITE 425
PORTLAND, OR 97232

Consultant Phone #
(503) 231-6078
Person to Contact
ALICE LARSON
FAX ( ) –

Generation Site (Transport from)
PORT OF PORTLAND
TERMINAL 5 – RIVERGATE
PORTLAND, OR

Site Phone #
( ) –
Person to Contact
FAX ( ) –

BTEX ppb
TPH 16000F ppm
PAH ppb ppm

Designated Facility (Transport to)
TPST SOIL RECYCLERS OF OREGON
9333 NORTH HARBORGATE STREET
PORTLAND, OR 97203

Facility Phone #
(503) 735-9525
Person to Contact
GLENNA MULLAN
FAX (503) 240-1712

Transporter Name and Mailing Address

Transporter Phone #
( ) –
Person to Contact
FAX ( ) –

Transporter ID (EPA/State)
Transporter Job #
Customer Account Number

Soil Type	Moisture Content	Contamination	Approved	Denied	Date Out	Gross Weight	Tare Weight	Net Weight
Sand ☐ Organic ☐ Clay ☐ Other ☐	0-10% ☐ 10-20% ☐ 20%-over ☐	Gas ☐ Diesel ☐ Other ☐				7640	2160	5480
Sand ☐ Organic ☐ Clay ☐ Other ☐	0-10% ☐ 10-20% ☐ 20%-over ☐	Gas ☐ Diesel ☐ Other ☐					7.74	

List any exceptions to items listed above:

Generator and/or consultant's certification: I/We certify that the soil referenced herein is taken entirely from those soils described in the Soil Data Sheet completed and certified by me/us for the Generation Site shown above and nothing has been added or done to such soil that would alter it in any way.

Print or Type Name: Generator ☐ Consultant ☐ Signature and date: Month Day Year

Transporter's certification: I/We acknowledge receipt of the soil described above and certify that such soil is being delivered in exactly the same condition as when received. I/We further certify that this soil is being directly transported from the Generation Site to the Designated Facility without off-loading, adding to, subtracting from or in any way delaying delivery to such site.

Print or Type Name: BRET GUFFLAN Signature and date: 8 14 95

Discrepancies:

Recycling Facility certifies the receipt of the soil covered by this manifest except as noted above:

Print or Type Name: Glenna Mullan Signature and date: 8.14.95

GENERATOR / CONSULTANT'S COPY

Yellow Copy - Generator and/or Consultant White Copy - Transporter Pink Copy - Recycling Facility

TPS Technologies Soil Recycling
Non-Hazardous Soils

Manifest #

Date of Shipment:	Responsible Party:	Transporter Truck #:			Load #
— —	GENERATOR	CET	09	01316	003

Generator and/or Consultant

Generator's Name and Billing Address
PORT OF PORTLAND
P. O. BOX 3529
PORTLAND, OR 97208

Generator's Phone #
( ) —
Person to Contact
FADRAIC QUINN
FAX #
(503) 240-2009

Consultant's Name and Billing Address
CENTURY WEST ENGINEERING
825 NE MULTNOMAH, SUITE 425
PORTLAND, OR 97232

Consultant's Phone #
(503) 231-6078
Person to Contact
ALICE LARSON
FAX #
( ) —

Generation Site (Transport from) (Name and Address)
PORT OF PORTLAND
TERMINAL 5 - RIVERGATE
PORTLAND, OR

Site Phone #
( ) —
Person to Contact
FAX #
( ) —

PCB's
ppb
TPH
16000F ppm
ppb ppm

Designated Facility (Transport to) (Name and Address)
TPST SOIL RECYCLERS OF OREGON
9333 NORTH HARBORGATE STREET
PORTLAND, OR 97203

Facility Phone #
(503) 735-9525
Person to Contact
GLENNA MULLAN
FAX #
(503) 240-1712

Transporter Name and Mailing Address:

Transporter's Phone #
( ) —
Person to Contact
FAX #
( ) —

Soil Type	Soil Contaminants	Contaminants	Quantity	Description of Debris	Gross Weight	Tare Weight	Net Weight
Sand ☐ Organic ☐ Clay ☐ Other ☐	0-10% ☐ 10-20% ☐ 20%-over ☐	Gas ☐ Diesel ☐ Other ☐			27980	12360	15620
Sand ☐ Organic ☐ Clay ☐ Other ☐	0-10% ☐ 10-20% ☐ 20%-over ☐	Gas ☐ Diesel ☐ Other ☐				7.81	

List any exception to items listed above:

Generator's and/or consultant's certification: I/We certify that the soil referenced herein is taken entirely from those soils described in the Soil Data Sheet completed and certified by me/us for the Generation Site shown above and nothing has been added or done to such soil that would alter it in any way.

Print or Type Name: Generator ☐ Consultant ☐ Signature and date: Month Day Year

Transporter's certification: I/We acknowledge receipt of the soil described above and certify that such soil is being delivered in exactly the same condition as when received. I/We further certify that this soil is being directly transported from the Generation Site to the Designated Facility without off-loading, adding to, subtracting from or in any way delaying delivery to such site.

Print or Type Name: Glenna Mullan Signature and date: Month 8 Day 14 Year 95

Discrepancies:

Recycling Facility certifies the receipt of the soil covered by this manifest except as noted above:

Print or Type Name: Glenna Mullan Signature and date: 8-14-95

Recycling Facility

GENERATOR / CONSULTANT'S COPY

TPS Technologies Soil Recycling
Non-Hazardous Soils

Manifest #

Date (GS)	Approval # for Shipment	Transporter Truck #	Facility #	Generator ID	Load #
	GENERATOR	CET	09	01316	004

Generator Name and Billing Address
PORT OF PORTLAND
PORTLAND, OR 97208

Generator's Phone #: ( ) –
Person to Contact: PADRAIC QUINN
FAX #: (503) 240-2009

Consultant Name and Billing Address
ENTRIX WEST ENGINEERING
825 NE MULTNOMAH, SUITE 425
PORTLAND, OR 97232

Consultant's Phone #: (503) 231-6078
Person to Contact: ALICE LARSON
FAX #: ( ) –

Generation Site (Name and Address)
PORT OF PORTLAND
TERMINAL 5 - RIVERGATE
PORTLAND, OR

Site Phone #: ( ) –
Person to Contact:
FAX #: ( ) –

16000F ppb ppm
ppb ppm

Designated Facility (Transporter) Name & Address
TPST SOIL RECYCLERS OF OREGON
9333 NORTH HARBORGATE STREET
PORTLAND, OR 97203

Facility Phone #: (503) 735-9525
Person to Contact: GLENNA MULLAN
FAX #: (503) 240-1712

Transporter Name and Mailing Address

Transporter's Phone #: ( ) –
Person to Contact:
FAX #: ( ) –

Sand ☐ Organics ☐ Silt ☐ Clay ☐ Other ☐	0-10% ☐ 10-20% ☐ 20%-over ☐	Gas ☐ Diesel ☐ Other ☐			29200	12160	17040
Sand ☐ Organics ☐ Silt ☐ Clay ☐ Other ☐	0-10% ☐ 10-20% ☐ 20%-over ☐	Gas ☐ Diesel ☐ Other ☐				8.52	

Description to remediation above:

Generator and/or consultant certification: I/We certify that the soil referenced herein is taken entirely from those soils described in the Soil Data Sheet completed and certified by me/us for the Generation Site shown above and nothing has been added or done to such soil that would alter it in any manner.

Print or Type Name: ☐ Generator ☐ Consultant | Signature and date: | Month | Day | Year

Transporter certification: I/We acknowledge receipt of the soil described above and certify that such soil is being delivered in exactly the same condition as when received. I/We further certify that this soil is being directly transported from the Generation Site to the Designated Facility without spilling, adding to, subtracting from or in any way delaying delivery to such site.

Print or Type Name: | Signature and date: | Month: 8 | Day: 14 | Year: 95

Transporter

Recycling facility certifies the receipt of the soil covered by this manifest except as noted above:

Print or Type Name: Glenna Mullan | Signature and date: Glenna Mullan 8-14-95

Generator and/or Consultant Copy — TRANSPORTER'S COPY — Receiving Facility Copy

Harbor Oil, Inc.

№ 22438

11535 N. Force Avenue
(503) 285-4648 Portland, Oregon 97217

INDUSTRIAL FUEL OILS
DIESEL

DUST OIL ASPHALTS
DISTRIBUTOR - SERVICE

CONSIGNEE Harbor Oil DATE 8-11-95

DESTINATION Portland OR CARRIER [redacted] CET

SHIPPER CET PURCHASE NO. 94208-N

	SHIPPING NAME	CLASSIFICATION	I.D. NO.	PLACARD NO.
CONTENTS	Non	Hazardous Liquid		None

	PRODUCT	GALS LOADED
TRK NO. 101007	Oily	
TRL NO.	Water	
	TOTALS	1200

EMERGENCY CONTACT # 1-800-473-2042
EPA # ORD 071803985

NET GALS	BBLS	TONS

	WEIGHT	LOADING	UNLOADING
API			
TEMP	GROSS	TIME DUE	TIME DUE
CORR FACTOR	TARE	TIME START	TIME START
WT GAL	NET	TIME FINISH	TIME FINISH

HAL
DIST
SW
SS

REMARKS:

Office Use Only

UNIT PRICE

PRODUCT	SUB TOTAL
FREIGHT	SUB TOTAL
TAX	SUB TOTAL
HOURS	SUB TOTAL
TOTAL	

DRIVER [redacted] JOB# 1590-001 RECD BY

WHITE: Customer CANARY: Office PINK: Billing GOLDENROD: Yard

EPA #ORD 001010289
PUC #206271

STRAIGHT BILL OF LADING

ORIGINAL - NOT NEGOTIABLE

CET ENVIRONMENTAL SERVICES, INC.
5315 NW St. Helens Rd.
Portland, OR 97210
Phone (503) 241-3827 FAX (503) 241-8259

Shipper No. 1590-001
Carrier No 5615
Date 8-11-95

TO: Consignee Harbor Oil
Street 11535 N. Force Ave.
Destination Portland, Or Zip Code

FROM: Shipper Port of Portland
Street I-5 / N. Lombard
Origin Portland, Or

Route
Vehicle Number 101207

No. Shipping Units	HM*	Kind of Packaging, Description of Articles, Special Marks and Exceptions	Weight (subject to correction)	Rate	CHARGES
~~1400~~ 1200		gal. Oily H_2O From Excavation Pit NOT Hazardous NOT Regulated by DOT	11200lbs		
		John Ostlund			
		If spill should occur, dike and contain material, then call CET Environmental Services 24 hour spill response at (503) 241-3827.			

REMIT C.O.D. TO:
ADDRESS

COD Amt: $

C.O.D. FEE:
PREPAID ☐
COLLECT ☐ $

NOTE—Where the rate is dependent on value, shippers are required to state specifically in writing the agreed or declared value of the property.
The agreed or declared value of the property is hereby specifically stated by the shipper to be not exceeding.
$ _____ per _____

This is to certify that the above named materials are properly classified, described, packaged, marked, and labeled, and are in proper condition for transportation according to the applicable regulations of the Department of Transportation.
_____ Signature

Subject to Section 7 of the conditions, if this shipment is to be delivered to the consignee without recourse on the consignor, the consignor shall sign the following statement:
The carrier shall not make delivery of this shipment without payment of freight and all other lawful charges.
_____ (Signature of Consignor)

TOTAL CHARGES: $

FREIGHT CHARGES:
FREIGHT PREPAID Check box if charges are to be collect except when box ☐ right is checked

RECEIVED, subject to the classifications and lawfully filed tariffs in effect on the date of the issue of this Bill of Lading, the property described above in apparent good order, except as noted (contents and condition of contents of packages unknown), marked, consigned, and destined as indicated above which said carrier (the word carrier being understood throughout this contract as meaning any person or corporation in possession of the property under the contract) agrees to carry to its usual place of delivery at said destination, if on its route, otherwise to deliver to another carrier on the route to said destination. It is mutually agreed as to each carrier of all or any of, said property over all or any portion of said route to destination and as to each party at any time interested in all or any said property, that every service to be performed hereunder shall be subject to all the bill of lading terms and conditions in the governing classification on the date of shipment.

Shipper hereby certifies that he is familiar with all the bill of lading terms and conditions in the governing classification and the said terms and conditions are hereby agreed to by the shipper and accepted for himself and his assigns.

SHIPPER

PER

CARRIER CET ENVIRONMENTAL SERVICES, INC.

PER Samuel Griffith

DATE 8-11-95

* Hazardous Materials

927179 COMPUTER FORMS, INC. (503) 620-4420 / (800) 547-88

1590-001

PACIFIC ROCK PRODUCTS

266221

DATE

☐ 18208 S.E. 1st ST • CAMAS, WA 98607
☐ 19201 S.E. 34th ST • CAMAS, WA 98607
☐ 8705 N.E. 117th AVE. • VANCOUVER, WA 98662
☐ 25902 N.E. 109th AVE. • BATTLE GROUND, WA 98604

08/15/95
09:09:37 am

SOLD TO: 94227N

CET ENVIRONMENTAL

T5 PORT OF PORTLAND

DELIVERED TO:
WC11 W COAST

JOB #	DRIVER	CUST. #
1307		03093

MATERIAL ☐ LOADED

MATERIAL: 207 SCREENINGS

OTHER:

GROSS: ~~89280 Lbs~~

TARE: 30780 Lbs

NET ~~58420 Lbs~~ ~~29.21TN~~

STANDBY TIME: 29.21 1

REASON: Total Volume Today Load No.

CUSTOMER AUTHORIZATION X

Our drivers will make every effort to place material where customer designates, but the company assumes no responsibility for damages inside the curb or property lines. Claims for shortage will not be allowed unless made at the time this material was delivered. You will be charged for excess time if shown on this ticket. The buyer agrees to pay all costs, including attorney fees incurred in any collection expense to effect payment for above materials.
CREDIT TERMS: NET 15TH. A FINANCE CHARGE WILL BE IMPOSED ON PAST DUE ACCOUNTS. THE FINANCE CHARGE IS COMPUTED BY A "PERIODIC RATE" OF 1½% PER MONTH, WHICH IS AN ANNUAL PERCENTAGE RATE OF 18%.

MATERIAL RECEIVED BY X CET

WEIGHMASTER X

CONTROL

1590-001

Angell Bros. Inc.

P.O. Box 83449
Portland, OR 97283-0449 $15.45
286-4201

Sold to: CET Environmental

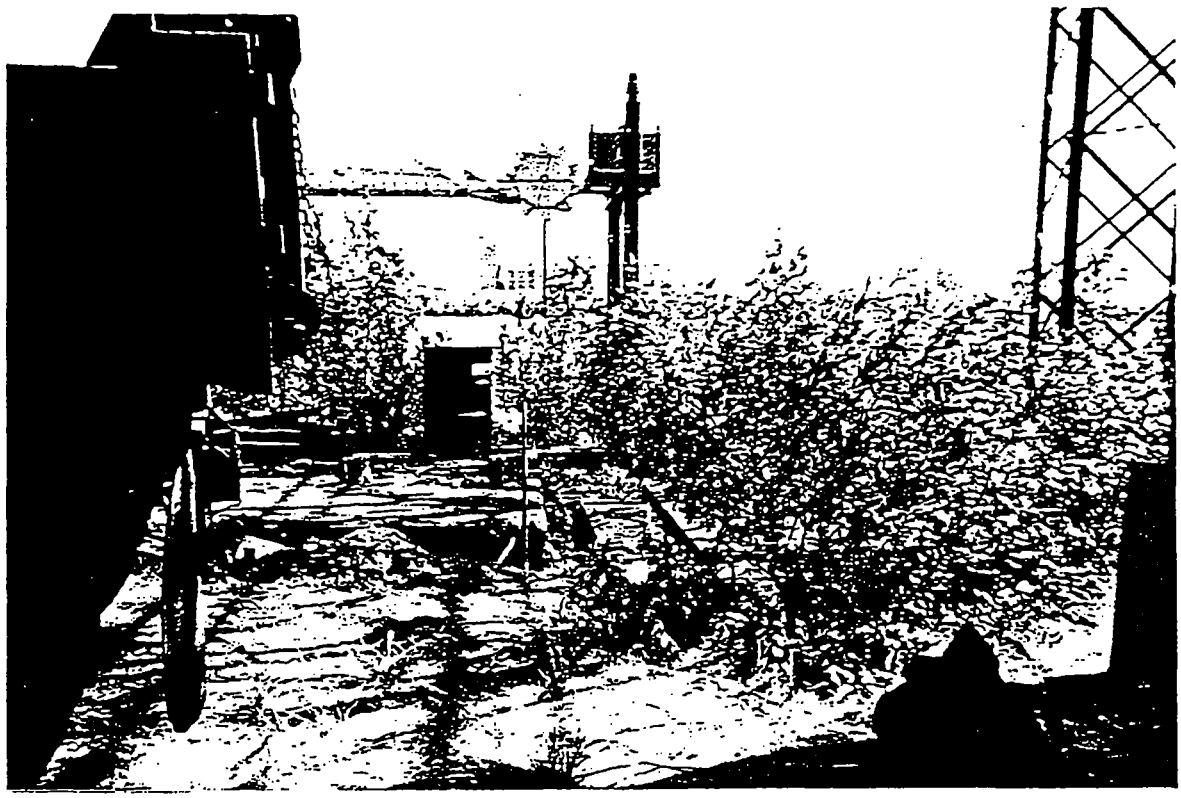
Address:

Quantity	Description	Price	Amount
5 yd	Reject	2.45	12.25
	Paid	Cash	

Driver

APPENDIX C

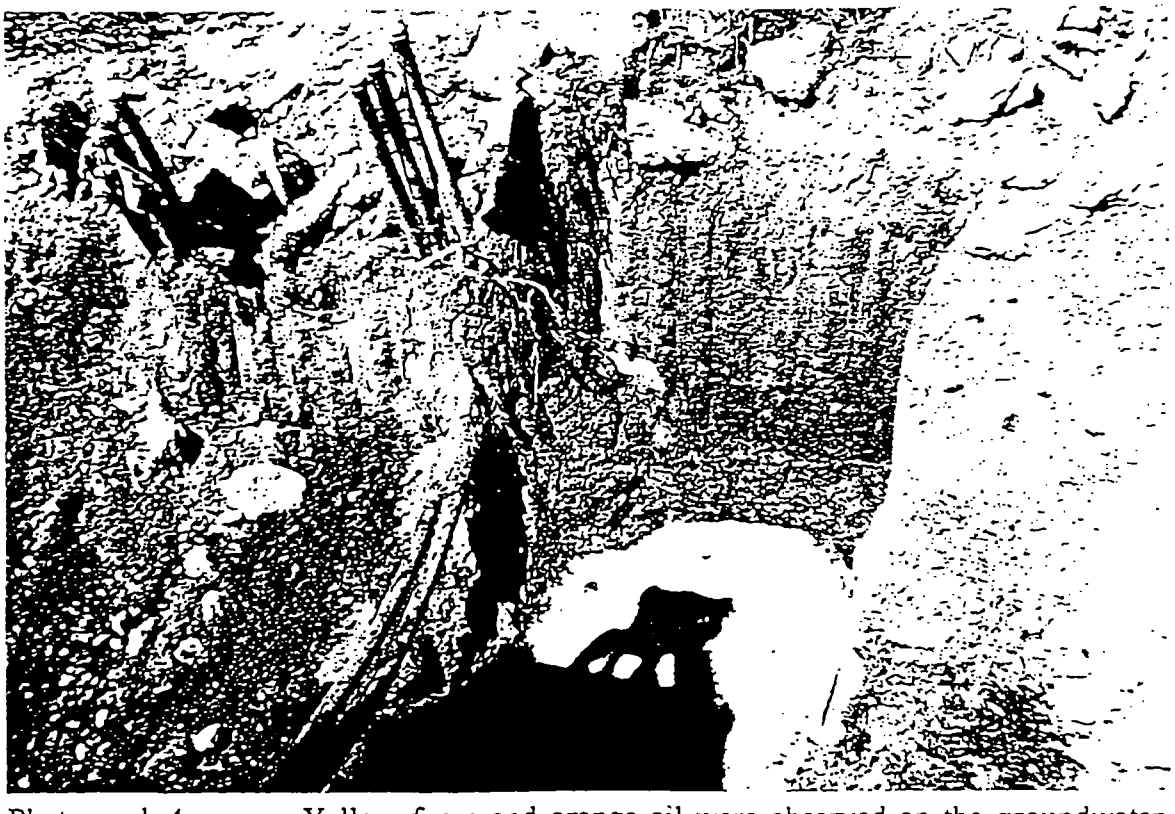
PHOTOGRAPH LOG



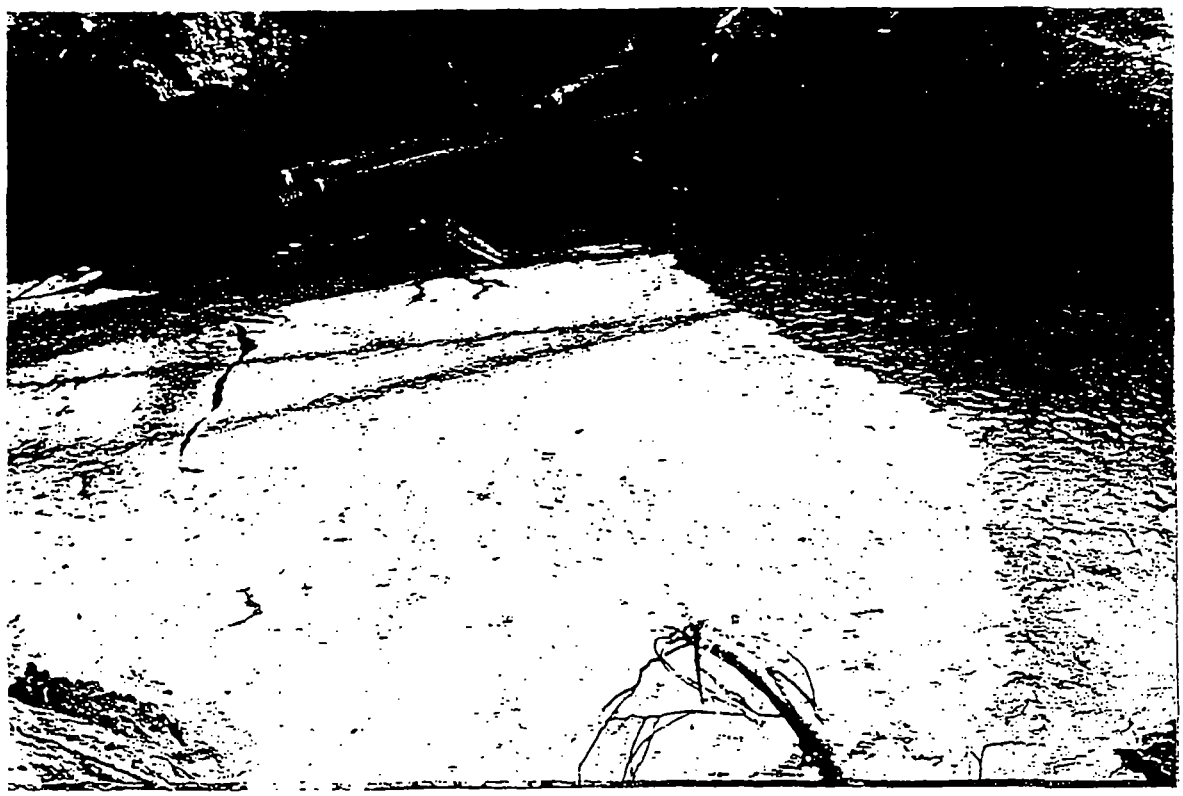
Photograph 1. The transformer oil spill occurred between the two concrete pads.

Photograph 2. A smaller, old spill, located on the east side of the concrete pads, was also remediated.

Photograph 3. Excavation activities were performed June 1, 1995. Groundwater was encountered at 3-1/2 feet below ground surface.



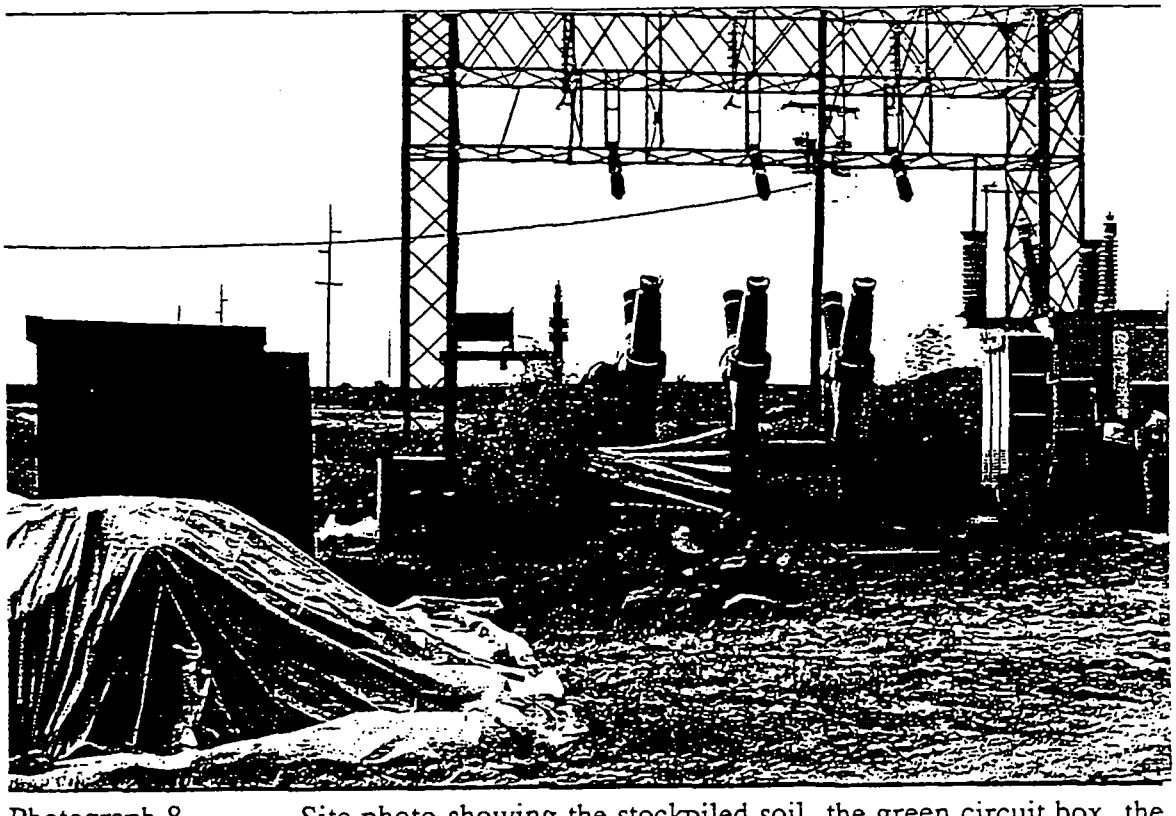
Photograph 4. Yellow foam and orange oil were observed on the groundwater table during the excavation activities.



Photograph 5. Excavation the morning of June 2, 1995. Static groundwater level was at 2-1/2 feet below ground surface.

Photograph 6. Approximately 1,200 gallons of groundwater was pumped into temporary holding tanks on June 2, 1995.

Photograph 7. Groundwater recharge that groundwater sample EX-W1 was obtained from on June 2, 1995.



Photograph 8. Site photo showing the stockpiled soil, the green circuit box, the excavation area, and the damaged transformer.

FIGURES

Attachment F
1997 Sediment Characterization Study
Port of Portland Terminal 5

Seattle Job File

Sampling and Analysis Plan for Sediment Characterization at Terminals 1, 2, and 5

Prepared for
Port of Portland
Portland, Oregon

October 22, 1996
J-5589

CONTENTS

CONTENTS

ACRONYMS

BT	Bioaccumulation Triggers
COC	Chemical of Concern
Corps	U.S. Army Corps of Engineers
CRD	Columbia River Datum
DEQ	Oregon Department of Environmental Quality
DGPS	Differential Global Positioning System
DMMU	Dredge Material Management Unit
EPA	United States Environmental Protection Agency
ML	Maximum Level
PAH	Polycyclic Aromatic Hydrocarbons
PCB	Polychlorinated Biphenyl
Port	Port of Portland
PSDDA	Puget Sound Dredged Disposal Analysis
QA/QC	Quality Assurance/Quality Control
SL	Screening Level
TBT	Tributyltin

SAMPLING AND ANALYSIS PLAN FOR SEDIMENT CHARACTERIZATION AT TERMINALS 1, 2, AND 5

1.0 INTRODUCTION

1.1 Project Description

The Port of Portland proposes to conduct maintenance dredging at Marine Terminals 1, 2, and 5 located on the Willamette River (see vicinity and location maps, Figures 1 through 5) to remove sediment that has accumulated primarily as a result of the floods occurring in the winter of 1995-1996. At Terminal 1, maintenance dredging is proposed along Berth 104 to maintain berth elevation of -25 feet below Columbia River Datum (CRD) and would remove approximately 7,987 cubic yards of material from the mooring area. At Terminal 2, maintenance dredging is proposed for Berths 204, 205, and 206, to maintain berth elevation of - 40 feet and would remove approximately 10,053 cubic yards of material from the mooring area. At Terminal 5, maintenance dredging is proposed for the barge slip to maintain berth elevation of - 15 feet and would remove approximately 1,221 cubic yards of material from the barge slip. Estimated total dredging quantity for the three terminals is approximately 19,261 cubic yards, including one foot of overdredge.

Dredging will be by clamshell and barge. Depending on the results of the sediment characterization proposed in this sampling plan, disposal will be either inwater to Morgan Bar (Columbia River at Mile 100 - 101), or confined inwater at the Ross Island Disposal Facility. It is possible that each site may receive some of the dredged materials.

1.2 Sediment Description

Based on historical data gathered at these three terminals, it is anticipated that the majority of the dredge material will consist of fine grained sediments containing 60 to 90 percent fines and 6 to 9 percent total volatile solids. In this section, existing sediment quality data from the terminals is compared to sediment screening levels set forth in the Dredged Material Management Manual for Grays Harbor and Willapa Bay (Corps, 1995).

At Terminal 1, Berth 104, maintenance dredging was conducted in 1974 with the removal of 1,300 cubic yards and again in 1975 with the removal of an additional 60,000 cubic yards of dredge material. The sediment was characterized as 87% silt/clay with 7.9% total volatile solids. A sediment

quality summary of Berth 104 from December 1, 1982, indicated that detectable concentrations of the copper, lead, arsenic, and PCB-1260 were found in the sediment, though these concentrations were below sediment screening levels.

At Terminal 2, Berth 204, maintenance dredging was conducted in 1990 (13,000 cubic yards removed), 1993 (7,000 cubic yards removed), and 1995 (5,000 cubic yards removed). The sediment was characterized as 86.3% silt/clay with <8.6% total volatile solids. A sediment quality summary of Berth 204 from September 16, 1995, indicated that detectable concentrations of the copper, lead, arsenic, Polycyclic Aromatic Hydrocarbons (PAHs), and tributyltin (TBT) were found in the sediment, though these concentrations were below screening levels.

At Terminal 2, Berths 205 and 206, maintenance dredging was conducted in 1975 and 1980 with an unknown volume of dredge material removed and in 1984 (5,700 cubic yards removed), 1988 (4,200 cubic yards removed), 1990 (2,800 cubic yards removed), 1993 (7,000 cubic yards removed), and 1995 (5,000 cubic yards removed). For these sediments, grain size characterization ranged from 81.3 to 83.7% silt/clay with total volatile solids ranging from 8.9 to 9.2%. A sediment quality summary of Berth 205 and 206 from September 16, 1995, indicated that detectable concentrations of the copper, lead, arsenic, PAHs, and tributyltin were found in the sediment. The concentrations of metals and PAHs were below screening levels. The concentrations of TBT (204 ug/kg at Berth 205) were above the current PSDDA (Corps, 1995) TBT screening level of 30 ug/kg but between the minimum and maximum TBT screening levels presented in draft EPA guidance (Weston, 1996). The dredge material from 1995 was disposed of in the confined inwater disposal facility at Ross Island.

At Terminal 5, Berth 501, maintenance dredging was conducted in 1988 (2,250 cubic yards removed) and 1992 (1,350 cubic yards removed). The sediment was characterized as fine-grained with 63.2% silt/clay and a total volatile solids of <6.9%. A sediment quality summary of Berth 501 from September 16, 1995, indicated that detectable concentrations of the copper, lead, arsenic, PAHs, and TBT. The concentrations of metals and PAHs were below PSDDA screening levels, and the concentrations of TBT (average 45.8 ug/kg at Terminal 5) was above the current PSDDA TBT screening level of 30 ug/kg.

1.3 Site Description

Terminal 1 is an older marine facility which is undergoing conversion to non-maritime trade uses. The present marine activity is limited to shallow draft uses. Berth 104 was upgraded in 1992 and leased by the Maritime Administration from 1992-1994. It is currently used as a layberth. The Terminal 1 area is being redeveloped for urban waterfront uses. Future marine activity will continue to be limited to shallow draft needs.

Terminal 2 is a general cargo facility for breakbulk, container, and Ro-Ro vessels. Berths 205-206 were upgraded in 1966 and are currently used by deep draft vessels. Berth 204 was upgraded in 1986 and is also used by deep draft vessels. Based on the recent 10-year dredging history, it appears Berths 204-206 are depositional areas which will require dredging every few years.

Terminal 5 is a bulk cargo facility. Berth 501 is a grain terminal, primarily used for grain exports.

1.4 Permitting

A permit for routine maintenance dredging of Marine River Terminals along the Willamette River has been provided by the Corps to the Port of Portland. This permit (permit number 8760) expires on February 1, 2001. Additionally, the Port of Portland has received from the Corps a permit for disposal, at Morgan Bar, of material found suitable for unconfined open water disposal. Designation of acceptable disposal site(s) based on results of sediment characterization proposed herein is a critical remaining element prior to final project design.

2.0 PROGRAM OBJECTIVES AND CONSTRAINTS

The sediment characterization program objectives are summarized below:

- Characterize sediments to be dredged in conformance with Corps requirements to enable the Corps and Oregon Department of Environmental Quality (DEQ) to designate approved disposal option(s);

- Optimize the designation of Dredge Material Management Units acceptable for disposal inwater at the Morgan Bar disposal site while assuring that unacceptable sediments are disposed of at an approved confined inwater site;

- Collect, handle, and analyze representative sediment core samples of the proposed dredging prisms in accordance with protocols and Quality Assurance/Quality Control (QA/QC) requirements outlined in the Corps Draft Inland Testing Manual (June 1994);

- Composite and analyze sediment cores in a timely manner to meet the Port's maintenance dredging schedule and Corps requirements for sample holding times; and

- Locate representative sampling locations at Terminal 1, Berth 104, because sample access is limited by the vessel currently moored and grounded alongside the berth.

3.0 PROJECT TEAM AND RESPONSIBILITIES

The sediment characterization program will include: 1) project planning and agency coordination; 2) field sample collection; 3) laboratory preparation and analysis; 4) QA/QC management; and 5) final data report. Staffing and responsibilities are outlined below.

3.1 Project Planning and Coordination

Ms. Dana Siegfried, Port of Portland (Port), is the applicant's representative and the primary contact for administrative issues related to the Port's maintenance dredging program. Dr. Todd Thornburg, Hart Crowser, Seattle, WA will be the overall project manager responsible for developing and completing the sampling program, and the primary contact for technical issues related to this sampling plan and the sediment characterization report. Following plan approval by the Corps and DEQ, Dr. Thornburg will be responsible for timely and successful completion of the project. Dr. Thornburg will provide a copy of the approved sampling plan along with the Corps approval letter to all sampling and testing subcontractors, and coordinate any significant deviations from the approved sampling plan with the Corps and DEQ.

3.2 Field Sample Collection

Mr. Taku Fuji, Hart Crowser, will provide overall direction to the field sampling and laboratory analysis programs in terms of logistics, personnel assignments, field operations, and analytical laboratory selection. Mr. Fuji will supervise field collection of the sediment core samples. Mr. Fuji will also be responsible for assuring accurate sample positioning; recording sample locations, depths, and identification; assuring conformance to sampling and handling requirements including field decontamination procedures; photographing, physical evaluation, and logging the samples; and for chain of custody of the sample cores until they are delivered to the analytical laboratory.

3.3 Laboratory Preparation and Analyses

Mr. Fuji will be responsible for documenting sample preparation, observations, and chain of custody until the time he delivers the samples to Columbia Analytical Services in Kelso, WA. He will also instruct the analytical laboratory on the need to maintain required handling and analytical protocols including detection limit requirements for dredge

material characterization. Mr. Fuji will ensure that archived sediments are stored under proper conditions.

Ms. Abbie Spielman, Project Chemist, at Columbia Analytical Services will be responsible for physical and chemical analysis. Columbia Analytical Services will handle and analyze the submitted samples in accordance with Corps analytical testing protocols and QA/QC requirements. A written report of analytical results and QA/QC data will be prepared by Columbia Analytical Services and included as an appendix in the final report.

3.4 QA/QC Management

Mr. Fuji, will serve as Quality Assurance Representative for the sediment characterization project. He will perform quality assurance oversight for both the field sampling and laboratory programs. Mr. Fuji will stay fully informed of field program procedures and progress during sample collection, and laboratory activities during sample preparation and analysis. He will record and correct any activities which vary from the written sampling and analysis plan. He will also review the laboratory analytical and QA/QC data to assure that data are valid and procedures meet the required analytical quality control limits. Upon completion of the sampling and analytical program, Mr. Fuji will incorporate findings into a QA/QC report.

3.5 Final Data Report

Dr. Thornburg will provide technical oversight and review of the Final Data Report and the data analysis it contains. Mr. Fuji will be responsible for preparation of the Final Data Report, including descriptions of sample locations and depths; sampling, handling, and analytical methods; QA/QC; and compilation and interpretation of data.

4.0 SAMPLE COLLECTION AND HANDLING PROCEDURES

4.1 Definitions

The following definitions apply to this sampling program:

- **Dredging Prism.** The entire volume of sediments to be dredged, related side-slopes and one-foot overdepth (Terminal 1 to elevation -26.0 feet, CRD, Terminal 2 to elevation -41.0 feet, CRD, and Terminal 5 to elevation -16.0 feet, CRD).

- **Sediment Core.** The entire cumulative length of sediment core extracted by the coring device. This extends from the sediment/water interface down to the total sampling depth of the hole. Each sediment core is a sampling location identified by number in Table 1 and on Figures 3, 4, and 5.

- **Core Section.** Each core section is approximately 4 feet long, except where the total sampling depth leaves a core section less than 4 feet at the bottom of the dredging prism. In a few cases, slightly longer core sections (to 5 or 6 feet depth) may be composited if the sediment sequence is observed to be homogeneous during core processing. Core sections comprising each sediment core are designated alphabetically, beginning with "A" for the 4-foot surface layer and proceeding downward from the top in 4-foot increments, B, C, etc., to the bottom core section. Core sections are composited within Dredge Material Management Units for laboratory analyses.

- **Dredged Material Management Unit (DMMU).** The volume of dredged material for which a separate decision on suitability for unconfined open-water disposal can be made. DMMUs are represented by chemical testing of a single sample, composited from one or more core sections within the DMMU. Typically, two cores will be composited for analysis in each DMMU.

- **Surface and Subsurface Sediments.** Material encountered within the sediment core for use in compositing and subsequent chemical analyses. Surface sediments include those encountered within 4 feet of the sediment/water interface, with subsurface sediments encountered at depths greater than 4 feet below the sediment/water interface.

4.2 Number of Samples Required

The numbers of samples proposed for each terminal were selected in accordance with the Dredged Material Management Manual developed for Grays Harbor and Willapa Bay (Corps, 1995). This manual presents a classification scheme for dredge material that assigns a dredging area one of four possible ranks; high, moderate, low-moderate, and low. In that order, these ranks represent a best professional judgment of concern or potential risk, typically reflective of a scale of decreasing potential for adverse biological effects or decreasing concentration of chemicals of concern. Urban and industrialized areas are generally ranked high in the absence of sediment quality data to the contrary. As a conservative assumption, the dredge materials at the river terminals were assumed to be rated high and the intensity of sediment sampling developed accordingly. Therefore, following Corps guidance, the maximum volume of sediment that can be represented by a single chemical analysis is 4,000 cubic yards.

The estimated volume of materials to be dredged is:

- 7,987 cubic yards for Terminal 1;
- 10,053 cubic yards at Terminal 2; and
- 1,221 cubic yards at Terminal 5.

To characterize this dredge material, we propose to submit two samples from Terminal 1, three samples from Terminal 2, and one sample from Terminal 5 for chemical analysis. The samples from Terminals 2 and 5 will consist of composited sediment cores (two cores per composite). Based on access limitations at Terminal 1, a single core will be analyzed in each of the two DMMUs.

4.3 Sampling and Compositing Scheme

The sampling and analysis program is developed with consideration of site-specific project and environmental factors. A key requirement is assuring that if an individual DMMU (represented by one or more core sections) is found unsuitable for unconfined open water disposal, then that unit can be feasibly dredged independently from surrounding clean sediments so that the contaminated material can be disposed of at an alternate approved confined inwater site.

4.3.1 Sampling Scheme

Basic criteria for selecting sampling locations and compositing for analysis are contained in Corps guidance documents (Corps, 1994 and 1995).

Sample Locations. The sampling locations at each Terminal will be established as shown on Figures 3 through 5. At Terminal 1, the sampling will be constrained by the presence of the 665-foot vessel "Green Mountain State" grounded at Berth 104. Sampling locations will be attempted around the bow and stern of the vessel, at sufficient depth to take 4-foot cores (Figure 3). At Terminal 2, six sediment cores will be collected at 400-foot intervals along a transect parallel to the dock face, providing two cores each in DMMUs representing Berths 204, 205, and 206, and at a distance of 13-feet perpendicular to the dock face (Figure 4). At Terminal 5, two sediment cores are proposed at locations along the inner wall of the slip (Figure 5).

Core Sampling Depths. At Terminal 1, sediment cores at each location will be collected from the sediment-water interface down to an elevation of -26.0 feet CRD, i.e., to the design elevation of -25.0 feet plus one foot overdredge. At Terminal 2, sediment cores at each location will be collected from the sediment-water interface down to an elevation of -41.0 feet CRD, i.e., to the design elevation of -40.0 feet plus one foot overdredge. At Terminal 5, sediment cores at each location will be taken from the sediment-water interface down to an elevation of -16.0 feet CRD, i.e., to the design elevation of -15.0 feet plus one foot overdredge.

4.3.2 Compositing Scheme

Sample compositing will be conducted at Terminals 2 and 5 (see Table 1). The goal of sample compositing is to control analytical chemistry costs while maintaining the overall objective of obtaining an accurate representation and definition of the dredging area.

4.4 Field Sampling Schedule

The field sampling schedule is constrained by the shortest sample holding time (seven days). To safely meet the holding times for composited samples, the field samples will be composited and delivered for laboratory testing within three days of sampling. It is projected that the entire sampling program can be completed within three working days.

Initiation of sediment sampling will be preceded by preparation and cleaning of sample coring and handling equipment, acquisition of appropriate EPA-approved decontaminated sample containers from the analytic laboratory, and establishment of sampling locations along the river terminals.

4.5 Field Operations and Equipment

The field crew will be mobilized from Hart Crowser's Seattle Office. The field crew will make sure all equipment is in good working order prior to initiating the sampling program. All field sampling and sediment handling will conform to the procedures outlined in the Health and Safety Plan presented in Appendix A.

4.5.1 Sediment Sampling Equipment

The sampling vessel to be employed for the coring program will be provided by David Evans and Associates, Inc., of Portland, Oregon. The vessel is a 30-foot aluminum hull vessel, powered by an inboard engine and jet pump propulsion system. The vessel is equipped with an A-frame, 2,000 lb. capacity windlass, lines and blocks for handling sampling equipment, washdown pump, digital echosounder, and an integrated navigation system. The positioning system will be a Differential Global Positioning System (DGPS) which will provide positions every second with submeter accuracy for precise positioning of sample locations. The backup positioning system will be staking and taping from landmarks onshore; this alternate method should provide reasonable accuracy given the close proximity of the sampling locations to the terminals (i.e., within 100 feet).

Sediment cores will be collected using a vibracore operated by Golder Associates, Inc. A vibracoring system collects a continuous profile of sediments below mudline. The system utilizes a high frequency vibrating coring device which penetrates into the underlying sediments with minimal distortion. This method is ideal for collecting long, relatively undisturbed cores from a variety of sediment types. The vibratory head assembly and core barrels are deployed from the A-frame of the David Evans vessel.

The field representative will log each sample on a chain of custody form, noting the location, date, and time of collection. Subsequent chain of custody forms will be used to track the submittal of specific samples to the laboratory. A complete record of drilling and sampling operations will be maintained on the Sediment Sampling Form shown on Figure 6. Soil descriptions will be prepared using the system shown on the Key to Sediment Logs, which is presented on Figure 7.

4.5.2 Positioning

The objective of the positioning procedure is to accurately ($\pm$2m) determine and record the positions of all sampling locations. This determination will

be achieved by referencing each sampling location to state plane coordinates with the use of known survey control points and DGPS.

The following parameters will be documented at each sampling location:

- Horizontal location in state plane coordinates, as appropriate;
- Vertical elevation in feet (including mudline and river elevation above the mudline);
- Time and date; and
- River elevation referenced to Columbia River Datum.

These parameters will be measured using combinations of DGPS, river elevation gages, and back up methods (i.e., triangulation or taping to survey control points and/or terminal landmarks or structures).

Positioning while sampling will be performed using a DGPS which will provide positions every second with submeter accuracy for precise positioning of sample locations. The navigation system onboard the vessel will provide the vessel pilot with a navigation display to enable piloting to sample locations and recording of the exact location of the sediment core. As a back up, the visual horizontal triangulation method is proposed. Sampling locations will be identified by measuring the horizontal distance from the actual sampling location to a known survey control point and/or permanent structure to the nearest foot using an incremental tape measure. These horizontal measurements can be translated into state plane coordinates using project base maps.

4.5.3 Sample Collection Techniques

Sediment samples will be collected in the following manner:

- Vessel will maneuver to proposed sample locations and will anchor upstream of the proposed sample location.

- A decontaminated core tube the length of the desired penetration depth will be secured to the vibratory assembly and deployed from the vessel.

- The cable umbilical to the vibrator assembly will be drawn taut and perpendicular, as the core rests on the bottom sediment.

- Location of the umbilical hoist will be measured and recorded by the location control personnel, depth to sediment will be measured with a survey tape attached to the head assembly.

- A 4-inch, thin-walled, aluminum tube will be vibratory-driven into the sediment using two counter-rotating vibrating heads.
- A continuous core sample will be collected to the designated coring depth or until refusal.
- The depth of core penetration will be measured and recorded.
- The vibrator will be turned off and the core barrel will be extracted from the sediment using the winch.
- While suspended from the A-frame, the assembly and core barrel will be sprayed off and then placed on the vessel deck.
- The core sample will be evaluated at the visible ends of the core tube to ensure that retrieved sediment core reached the required depth and, if accepted, the core tube will be sectioned into four-foot lengths.

Sample recovery will be inspected relative to the following Hart Crowser acceptance criteria:

- Overlying water is present and the surface is intact;
- Calculated sediment compaction is not greater than 40 percent; and
- The core tube appears intact without obstruction or blocking.

Once the core samples are deemed acceptable, the cutter head will be removed and a cap will be placed over the end of the tube and secured firmly in place with duct tape. The core will then be removed from the sampler and the other end of the core will be capped and taped. A label identifying the core will be securely attached to the outside of the core and wrapped with transparent tape to prevent loss or damage of the label. The core sections will be stored on Blue Ice in coolers. The cores will be sealed tightly enough to prevent leakage or disturbance during transport.

As samples are collected, logs and field notes of all sediment samples will be maintained in a project notebook. Included in this log will be the following:

- Calculated elevation of each sediment sample as measured from the Columbia River Datum;
- Date and time of sampling.
- Initials of person supervising the sampling operation.

- Weather conditions.
- Sample location number and core section identification.
- Physical description of sediment.
- Chronological occurrence of events during sampling operations.

4.6 Equipment Decontamination Procedures

Sampling and sediment compositing equipment will be thoroughly cleaned prior to use and after each sample collection event. Sampling equipment will be decontaminated according to the following procedure:

- Wash with brush and Alconox soap;
- Rinse with tap water; and
- Rinse with deionized water.

After cleaning, all sampling equipment will be wrapped in foil or plastic to limit the risk of contamination.

All hand work (e.g., using stainless steel spoons for extracting the sample from the split cores, mixing the samples and filling sample containers) will be conducted with disposable latex gloves which will be rinsed with distilled water before and after handling each individual sample, as appropriate, to prevent sample contamination. Gloves will be disposed of between composites to prevent cross contamination between the DMMUs.

4.7 Sample Compositing and Subsampling

4.7.1 Extrusion

Core sections will have their sealed caps removed for extrusion. The sediment from each sample tube will be extruded onto a stainless steel tray using a foil-covered wooden dowel. The sample will be disturbed as little as possible when extruding. The foil covering on the dowel will be replaced between composites. Upon extrusion, the core will be split with a decontaminated stainless steel wire core splitter.

A color photograph will be taken and the sediment description of each core sample will be recorded on the sediment sampling log for the following parameters as appropriate and present:

- Sample recovery
- Physical soil description in accordance with the Unified Soil Classification System (includes soil type, density/consistency of soil, color)
- Odor (e.g., hydrogen sulfide, petroleum)
- Visual stratification, structure, and texture
- Vegetation
- Debris
- Biological Activity (e.g., detritus, shells, tubes, bioturbation, live or dead organisms)
- Presence of oil sheen
- Any other distinguishing characteristics or features

4.7.2 Compositing

Samples will then be composited by Hart Crowser per the compositing plan presented in Table 1 and in accordance with Corps guidance. For sediment composite samples, equal volumes of sediment will be removed from each core section comprising a composite. Sediments representing each composite sample will be placed in a stainless steel bowl and mixed using stainless steel mixing spoons or paddles. The composited sediment in the stainless steel bowl will be mixed until homogenous in color and texture.

4.7.3 Sample Volume

Approximately one liter of homogenized sample will be prepared to provide adequate volume for physical, and chemical laboratory analyses. Portions of each composite sample will be placed in appropriate containers obtained from the analytical chemistry laboratories. See Table 4 for container and sample size information.

Each sample container will be clearly labeled with the project name, sample/composite identification, type of analysis to be performed, date and time, and initials of person(s) preparing the sample, and referenced by entry into the log book. Samples will be stored at approximately 4°C until withdrawn for analysis.

4.9 Sample Transport and Chain of Custody Procedures

Containerized sediment samples will be transported to Columbia Analytical Services after compositing is completed. Specific sample shipping procedures will be as follows:

- Each cooler or container containing the sediment samples for analysis will be delivered to the laboratory within 24 hours of being sealed.
- Individual sample containers will be packed to prevent breakage and transported in a sealed ice chest or other suitable container.
- The shipping containers will be clearly labeled with sufficient information (name of project, time and date container was sealed, person sealing the container and consultant's office name and address) to enable positive identification.
- Glass jars will be separated in the shipping container by shock absorbent material (e.g., bubble wrap) to prevent breakage.
- Ice will be placed in separate plastic bags and sealed.
- A sealed envelope containing custody forms will be enclosed in a plastic bag and taped to the inside lid of the cooler.
- Signed and dated custody seals will be placed on all coolers prior to shipping.

Upon transfer of sample possession to the analytical laboratory, the custody form will be signed by the persons transferring custody of the sample container. Upon receipt of samples at the laboratory, the shipping container seal will be broken and the condition of the samples will be recorded by the receiver. Custody forms will be used internally in the lab to track sample handling and final disposition.

5.0 LABORATORY PHYSICAL AND CHEMICAL SEDIMENT ANALYSIS

5.1 Chemical Analyses Protocols

Laboratory testing procedures will be conducted in accordance with the Corps Draft Inland Testing manual. Several details of these procedures are discussed below.

5.1.1 Chain of Custody

A chain of custody record for each set of samples will be maintained throughout all sampling activities and will accompany samples and shipment to the laboratory. Information tracked by the chain of custody records in the laboratory include sample identification number, date and time of sample receipt, analytical parameters required, location and conditions of storage, date and time of removal from and return to storage, signature of person removing and returning the sample, reason for removing from storage, and final disposition of the sample.

5.1.2 Limits of Detection

The sediment composite samples identified in Table 1 will be analyzed for each of the parameters listed in Table 4. The analytical test methods and method detection limits to be achieved by the analytical laboratory are identified in Table 4. The testing laboratory (Columbia Analytical Services) is aware of the Corps detection limit requirements (i.e., screening levels in Corps, 1995) and will employ all reasonable means, including additional cleanup steps and method modifications, to bring detection limits below these screening levels. In addition, an aliquot (8 oz) of each composited sediment sample will be archived (frozen) at -20 °C for additional analysis if necessary.

In all cases, to avoid potential problems and leave open the option for retesting, sediments or extracts will be kept under proper storage conditions until the chemistry data are deemed acceptable by the Corps and DEQ.

5.1.3 Holding Times

All samples for physical and chemical testing will be maintained at the testing laboratory in accordance with the sample holding limitations and storage temperature requirements listed in Table 2.

5.1.4 Quality Assurance/Quality Control

The chemistry QA/QC requirements found in Table 3 will be met.

5.2 Laboratory Written Report

A written report will be prepared by the analytical laboratory documenting the activities associated with sample analyses. As a minimum, the following will be included in the report:

- Results of the laboratory analyses and QA/QC results.
- Protocols used during analyses.
- Chain of custody procedures, including explanation of any deviation from those identified herein.
- Any protocol deviations from the approved sampling plan.
- Location and availability of data.

As appropriate, this sampling plan may be referenced in describing protocols.

6.0 REPORTING

6.1 QA Report

The project quality assurance representative will prepare a quality assurance report based upon activities involved with the field sampling and review of the laboratory analytical data. The laboratory QA/QC reports will be incorporated by reference. This report will identify any field and laboratory activities that deviated from the approved sampling plan and the referenced protocols and will make a statement regarding the overall validity of the data collected. The QA/QC report will be incorporated into the Final Report.

6.2 Final Report

Hart Crowser will prepare a written report documenting all activities associated with collection, compositing, transportation, and analysis of samples. The chemical testing reports from the analytical laboratory will be included as appendices. As a minimum, the following will be included in the Final Report:

- Type of sampling equipment used.
- Protocols and procedures used during sampling and testing and an explanation of any deviations from the sampling plan protocols.
- Descriptions and core logs of each sample, including penetration and recovery depths, compositing intervals, mudline elevation, grain size, and geologic contacts.
- Methods used to locate the sampling positions within an accuracy of ±2m.
- Maps and tables identifying locations where the sediment samples were collected, reported in latitude and longitude to the nearest tenth of a second on State Plans Coordinates.
- A plan view of the project sites showing the terminals, bathymetry, and actual sampling locations.
- Chain of custody procedures used, and explanation of any deviations from the sampling plan procedures.

- Tabular summary of chemical testing results, with comparisons to Corps screening levels, and in the case of TBT, EPA draft screening levels.

- Final QA report as discussed above.

7.0 REFERENCES

Corps, 1994. Evaluation of Dredged Material Proposed for Discharge in Waters of the U.S. - Testing Manual (Draft): Inland Testing Manual. EPA 823-B-94-002.

Corps, 1995. Dredged Material Evaluation Procedures and Disposal Site Management Manual: Grays Harbor and Willapa Bay, Washington. Final Report June 1995.

Weston, 1996. Recommendations for a Screening Level for Tributyltin in Puget Sound Sediment. Prepared for EPA Region 10 Superfund Program. April 1996.

Table 1 - Proposed Sediment Sampling Locations, Depths, and Identification

Proposed Subsurface Core Location	Proposed Core Sample Bottom Elev. in Feet (CRD)	1996 Bathymetry in Feet (CRD)	Proposed Core Depth in Feet	DMMU Identification	Sample Identification	Approx. DMMU Volume in Cubic Yards
TERMINAL 1						
HC-VC-01	-26	-21	5	T1/B104	HC-T1-01	3,990
HC-VC-02	-26	-22	4	T1/B104	HC-T1-02	3,990
TERMINAL 2						
HC-VC-03	-41	-36	5	T2/B204	HC-T2-01	3,400
HC-VC-04	-41	-38	3	T2/B204	HC-T2-01	3,400
HC-VC-05	-41	-38	3	T2/B205	HC-T2-02	3,400
HC-VC-06	-41	-38	3	T2/B205	HC-T2-02	3,400
HC-VC-07	-41	-38	3	T2/B206	HC-T2-03	3,400
HC-VC-08	-41	-37	4	T2/B206	HC-T2-03	3,400
TERMINAL 5						
HC-VC-09	-16	-11	5	T5	HC-T5-01	1,220
HC-VC-10	-16	-13	3	T5	HC-T5-01	1,220

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Table 2 - Sample Storage Criteria

Sample Type	Holding Time	Sample Size[a]	Temperature[b]	Container
Particle Size	6 Months	100-200g (150 ml)	4°C	1-liter Glass (combined)
Total Solids	14 Days	125g (100 ml)	4°C	
Total Volatile Solids	14 Days	125 g (100 ml)	4°C	
Total Organic Carbon	14 Days	125 g (100 ml)	4°C	
Ammonia	7 Days	25 g (20 ml)	4°C	
Metals (except Mercury)	6 Months	50 g (40 ml)	4°C	
Semivolatiles, Pesticides and PCBs	14 Days until extraction 1 Year until extraction 40 Days after extraction	150 g (120 ml)	4°C 4°C 4°C	
Tributyltin	14 Days until extraction	50 g (40 ml)		
Mercury	28 Days	5 g (4 ml)	4°C	
Total Sulfides	7 Days	50g (40 ml)	4°C[c]	125 ml Plastic
Archive	1 year	--	-20°C	250 ml Glass

a. Recommended minimum field sample sizes for one laboratory analysis. Actual volumes to be collected have been increased to provide a margin of error and allow for retests.

b. During transport to the lab, samples will be stored on blue ice. The mercury and archived samples will be frozen immediately upon receipt at the lab.

c. The sulfides sample will be preserved with 5 ml of 2 Normal zinc acetate per 30 g of sediment.

Table 3 - Minimum Laboratory QA/QC

ANALYSIS TYPE	METHOD BLANKS	TRIPLICATES[5]	REPLICATES	MATRIX SPIKE[5]	SURROGATES[1]
Ammonia/Sulfides	X[5]	X			
Semivolatiles[2,3]	X[4]		X[6,7]	X	X
Pesticides/PCBs[2,3]	X[4]		X[6,7]	X	X
Metals	X[5]		X[5]	X	
Total Organic Carbon	X[5]	X			
Total Solids		X			
Total Volatile Solids		X			
Particle Size		X			

1. Surrogate spikes required for every sample, including matrix spiked samples, blanks and reference materials
2. Initial calibration required before any samples are analyzed, after each major disruption of equipment, and when ongoing calibration fails to meet criteria.
3. Ongoing calibration required at the beginning of each work shift, every 10-12 samples or every 12 hours (whichever is more frequent), and at the end of each shift
4. Frequency of Analysis (FOA) = one per extraction batch
5. FOA = 5% or one per batch, whichever is more frequent
6. FOA = <20 samples: one per batch; 20+ samples: 1 triplicate and additional duplicates for a minimum of 5% total replication
7. *Matrix spike duplicate will be run*

Table 4 - Analyte List and Targeted Detection Limits

Analytes	Analytical Method	TDL*
CHEMICAL PARAMETERS		
Metals in mg/kg (ppm)		
Antimony	U.S. EPA Method 200.8	0.01
Arsenic	U.S. EPA Method 200.8.	0.3
Cadmium	U.S. EPA Method 200.8	0.01
Chromium	U.S. EPA Method 200.8	0.1
Copper	U.S. EPA Method 200.8	0.03
Lead	U.S. EPA Method 7421	0.01
Mercury	U.S. EPA Method 200.8	0.05
Nickel	U.S. EPA Method 200.8	0.1
Silver	U.S. EPA Method 200.8	0.01
Zinc	U.S. EPA Method 200.8	0.3
Tributyltin (as tin) in mg/kg (ppb)	Krone et al. 1989	1
Phenol in mg/kg (ppb)	GC/MS-SIM	
Phenol	GC/MS-SIM	10
2-Methylphenol	GC/MS-SIM	10
4-Methylphenol	GC/MS-SIM	10
2,4-Dimethylphenol	GC/MS-SIM	10
Pentachlorophenol	GC/MS-SIM	10
LPAHs in mg/kg (ppb)		
Naphthalene	GC/MS-SIM	10
2-Methylnaphthalene	GC/MS-SIM	10
Acenaphthylene	GC/MS-SIM	10
Acenaphthene	GC/MS-SIM	10
Fluorene	GC/MS-SIM	10
Phenanthrene	GC/MS-SIM	10
Anthracene	GC/MS-SIM	10
HPAHs in mg/kg (ppb)		

Table 4 - Analyte List and Targeted Detection Limits

Analytes	Analytical Method	TDL*
Fluoranthene	GC/MS-SIM	10
Pyrene	GC/MS-SIM	10
Benz(a)anthracene	GC/MS-SIM	10
Chrysene	GC/MS-SIM	10
Total benzofluoranthenes	GC/MS-SIM	10
Benzo(a)pyrene	GC/MS-SIM	10
Indeno(1,2,3-cd)pyrene	GC/MS-SIM	10
Dibenz(a,h)anthracene	GC/MS-SIM	10
Benzo(g,h,i)perylene	GC/MS-SIM	10
Pesticides/PCBs in mg/kg (ppb)		
Total PCBs	U.S. EPA Method 8080A	10
4,4'-DDE	U.S. EPA Method 8080A	2
4,4'-DDD	U.S. EPA Method 8080A	2
4,4'-DDT	U.S. EPA Method 8080A	2
Chlordane (alpha, gamma)	U.S. EPA Method 8080A	10
Aldrin	U.S. EPA Method 8080A	2
Dieldrin	U.S. EPA Method 8080A	2
Heptachlor	U.S. EPA Method 8080A	2
Lindane	U.S. EPA Method 8080A	2
CONVENTIONAL PARAMETERS		
Grain size	PSEP	0.0001 g
Percent solids	PSEP	0.1%
Total volatile solids	PSEP/EPA 160.4M	0.1%
Total organic carbon	PSEP/ASTM D4129-82M	0.1%
Total sulfides	PSEP	2 mg/kg
Ammonia	U.S. EPA Method 350.1	1 mg/kg

* TDL = Targeted detection limit based on dry weight and assuming solids content greater than 50 percent and total organic carbon content greater than 1.5 percent. The TDLs shown are adequate for comparison with SMS criteria.

Vicinity Map

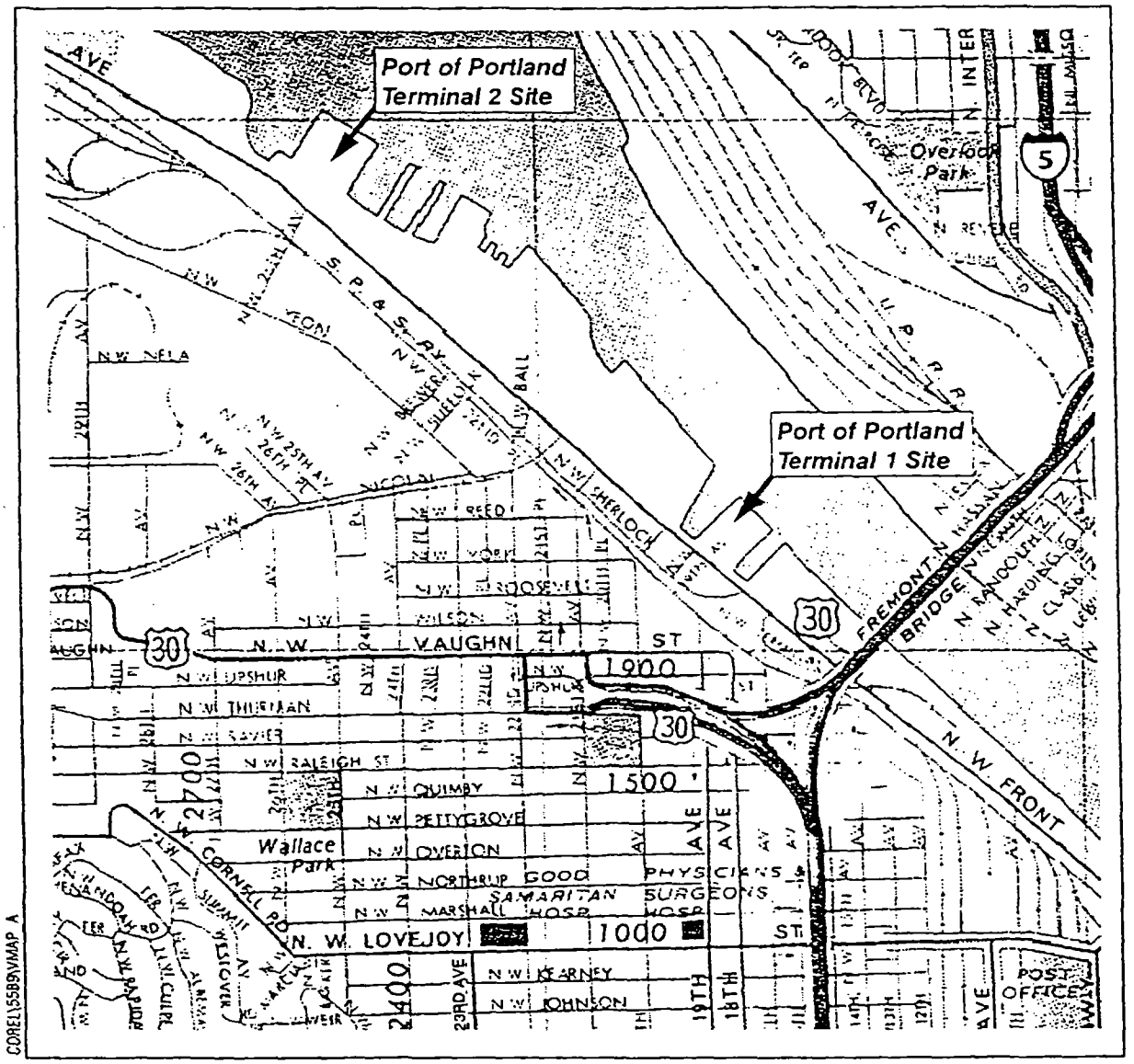

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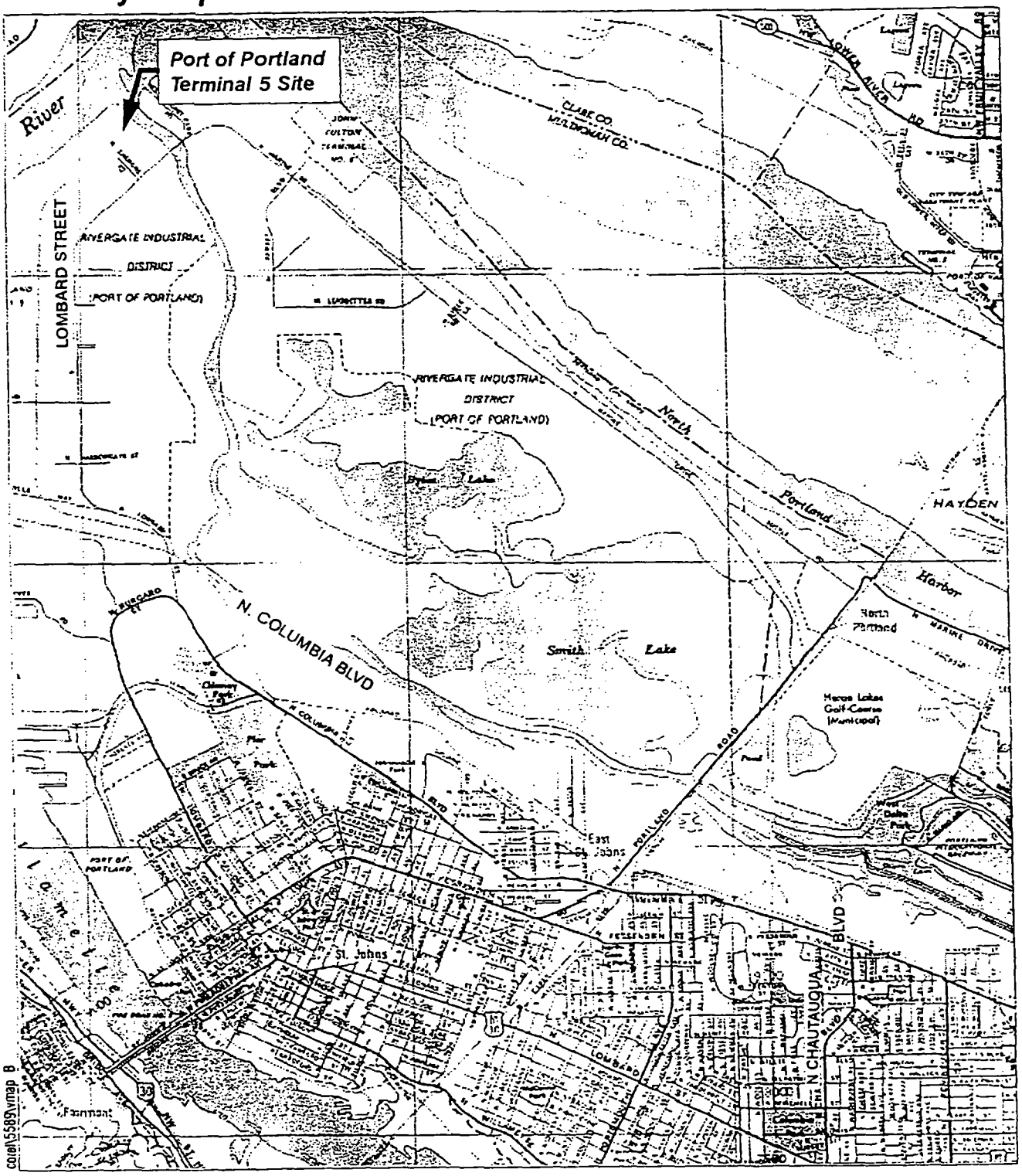
Figure 1

Vicinity Map



0 1/2 1

Scale in Miles

N

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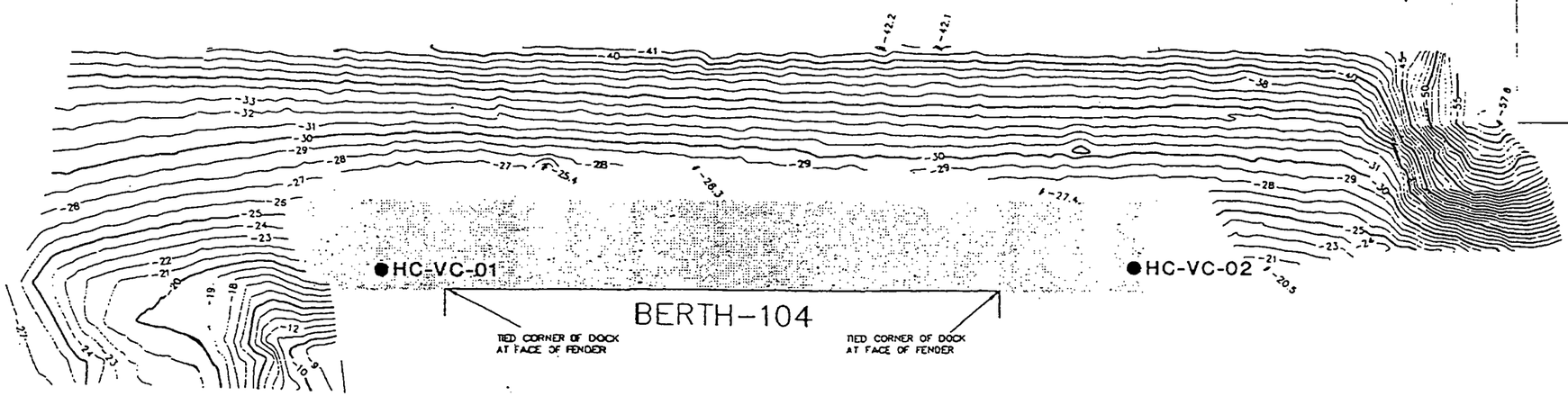
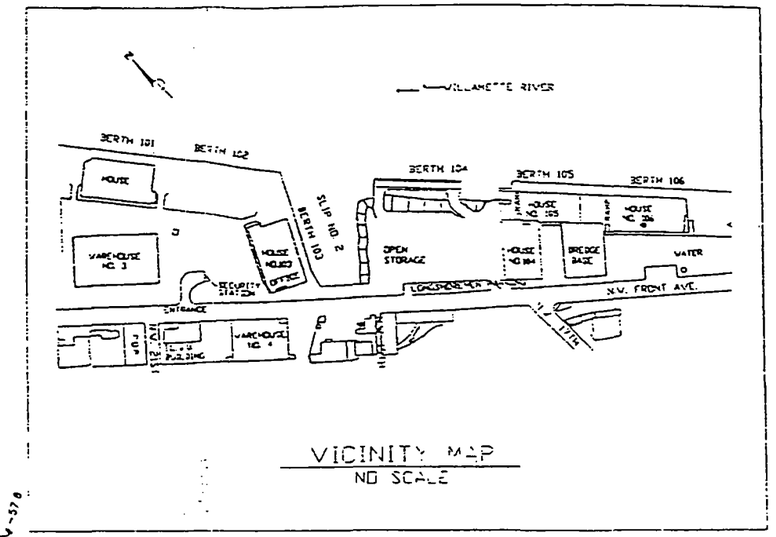
Figure 2

Proposed Sampling Location Plan - Terminal 1

Port of Portland





VICINITY MAP
NO SCALE

0 100 200
Scale in Feet

SEE NOTE 9

VOLUME CALCULATIONS

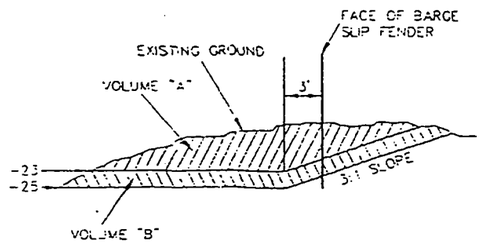
VOLUME "A" = 4219 CUBIC YARDS

VOLUME "B" = 3768 CUBIC YARDS

VOLUME "A" + VOLUME "B" = 7987 CUBIC YARDS

Proposed Dredging Prism (Approximate*)

● HC-VC-01 Proposed Sampling Location and Number



NOT TO SCALE

*Note: Hydrographic survey incomplete because grounded vessel prohibited berth access.

1. HORIZONTAL DATUM: ASSUMED

2. CONTOURS ARE SHOWN IN FEET AND INDICATE DEPTHS BELOW COLUMBIA RIVER DATUM ZERO. THE TIDE BOARD USED IS LOCATED AT BERTH-103.

3. HORIZONTAL POSITIONS FOR NAVIGATION AND DATA COLLECTION WERE DETERMINED BY USING A HYDRO-II RANGE-AZIMITH SYSTEM.

4. BATHYMETRIC DATA WERE COLLECTED USING AN INNERSPACE-448 ECHOSOUNDER WITH AN 8° SINGLE BEAM TRANSDUCER.

5. SURVEY DATA WERE COLLECTED LONGITUDINALLY WITH THE DOCK FACE USING A TWENTY-FIVE FOOT LINE SPACING. THE SURVEY DATA COLLECTED ALONG EACH SURVEY LINE WERE THINNED USING A "SHOAL BIAS" METHOD TO AN APPROXIMATE HORIZONTAL SPACING OF 5 FEET.

6. THERE MAY BE BOTTOM FEATURES THAT ARE NOT SHOWN ON THIS MAP BECAUSE OF THE LINE SPACING INTERVAL. THIS SURVEY DOES NOT INCLUDE BATHYMETRIC DATA BETWEEN THE ADJACENT SURVEY LINES.

7. THIS BATHYMETRIC SURVEY IS REPRESENTATIVE OF THE CONDITION OF THE RIVER BOTTOM AT THE TIME OF THE SURVEY BASED ON THE LINE SPACING INTERVAL AND THINNING METHOD USED. THE CONDITION OF THE RIVER BOTTOM MAY CHANGE AT ANY TIME AFTER THE DATE OF THIS SURVEY.

8. HYDROGRAPHIC SURVEY DATA COLLECTED: OCTOBER 2, 1996

9. THIS SURVEY IS FOR A VOLUME ESTIMATE ONLY. THE VOLUME IS NOT ACCURATE AS THERE WAS A SHIP IN THE BERTH AT THE TIME OF THE SURVEY, AND NO DATA COULD BE COLLECTED UNDER THE SHIP. THE VOLUME WAS CALCULATED BY EXTRAPOLATING THE DATA COLLECTED AROUND THE SHIP. THE CONTOURS SHOWN ARE ACCURATE AS THEY WERE GENERATED FROM THE ONLY DATA THAT COULD BE COLLECTED.

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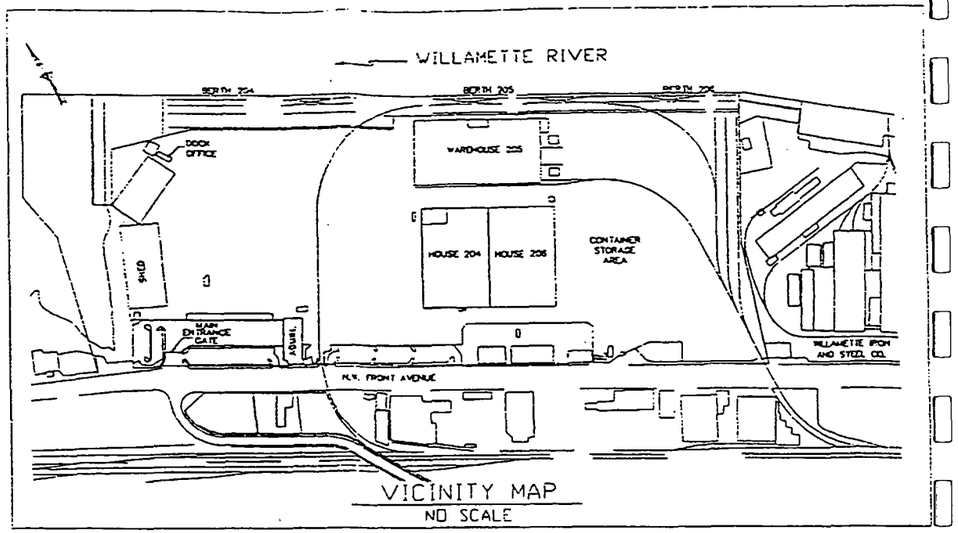
Figure 3

Proposed Sampling Location Plan - Terminal 2

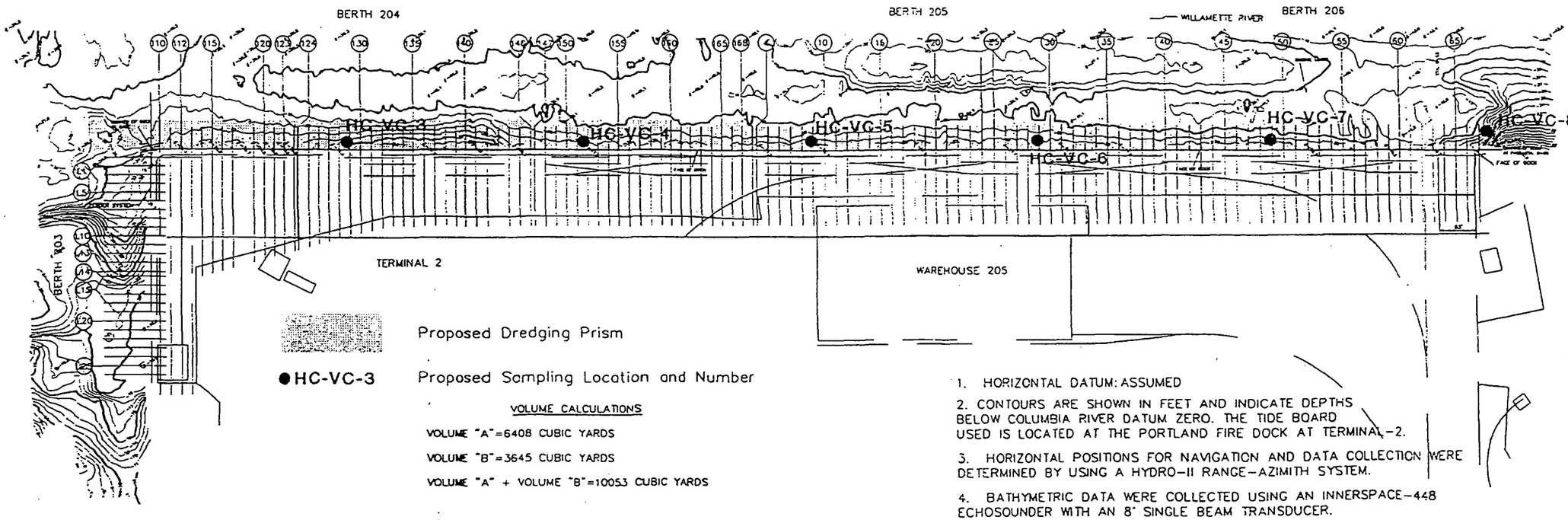
Port of Portland



VICINITY MAP
NO SCALE

0 200 400
Scale in Feet

WILLAMETTE RIVER



Proposed Dredging Prism

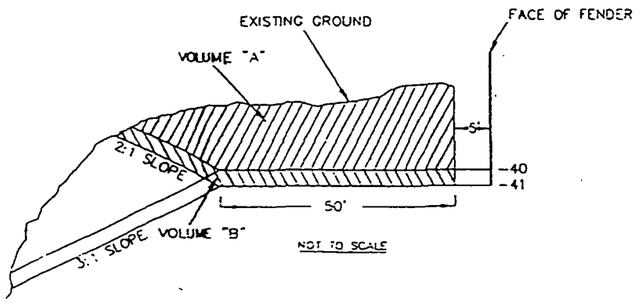
●HC-VC-3 Proposed Sampling Location and Number

VOLUME CALCULATIONS

VOLUME "A"=6408 CUBIC YARDS

VOLUME "B"=3645 CUBIC YARDS

VOLUME "A" + VOLUME "B"=10053 CUBIC YARDS



NOT TO SCALE

1. HORIZONTAL DATUM: ASSUMED
2. CONTOURS ARE SHOWN IN FEET AND INDICATE DEPTHS BELOW COLUMBIA RIVER DATUM ZERO. THE TIDE BOARD USED IS LOCATED AT THE PORTLAND FIRE DOCK AT TERMINAL-2.
3. HORIZONTAL POSITIONS FOR NAVIGATION AND DATA COLLECTION WERE DETERMINED BY USING A HYDRO-II RANGE-AZIMITH SYSTEM.
4. BATHYMETRIC DATA WERE COLLECTED USING AN INNERSPACE-448 ECHOSOUNDER WITH AN 8° SINGLE BEAM TRANSDUCER.
5. SURVEY DATA WERE COLLECTED LONGITUDINALLY WITH THE DOCK FACE USING A TWENTY-FIVE FOOT LINE SPACING. THE SURVEY DATA COLLECTED ALONG EACH SURVEY LINE WERE THINNED USING A "SHOAL BIAS" METHOD TO AN APPROXIMATE HORIZONTAL SPACING OF 5 FEET.
6. THERE MAY BE BOTTOM FEATURES THAT ARE NOT SHOWN ON THIS MAP BECAUSE OF THE LINE SPACING INTERVAL. THIS SURVEY DOES NOT INCLUDE BATHYMETRIC DATA BETWEEN THE ADJACENT SURVEY LINES.
7. THIS BATHYMETRIC SURVEY IS REPRESENTATIVE OF THE CONDITION OF THE RIVER BOTTOM AT THE TIME OF THE SURVEY BASED ON THE LINE SPACING INTERVAL AND THINNING METHOD USED. THE CONDITION OF THE RIVER BOTTOM MAY CHANGE AT ANY TIME AFTER THE DATE OF THIS SURVEY.
8. HYDROGRAPHIC SURVEY DATA COLLECTED: SEPTEMBER 5, 1996

exp 11/16/96 1=200 hc prp
J5589001

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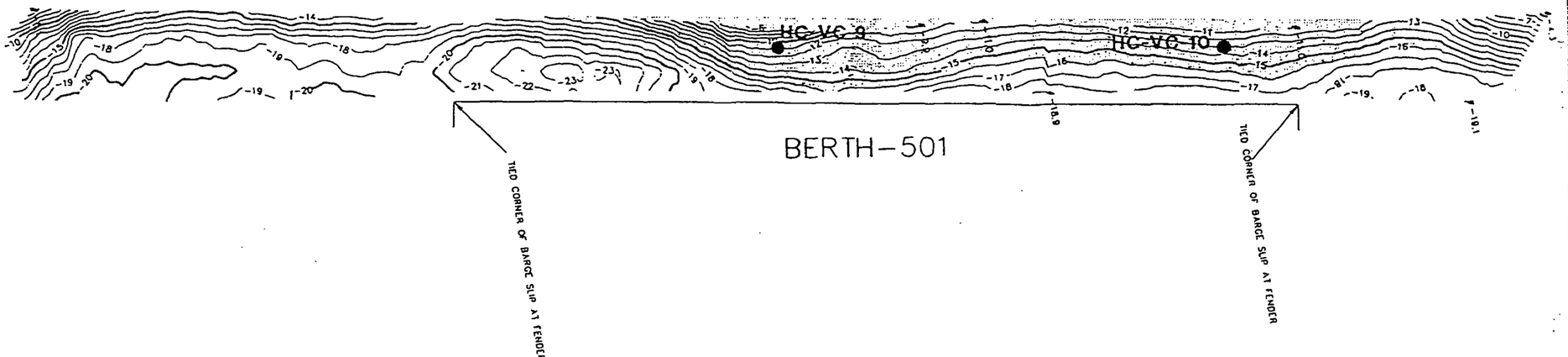
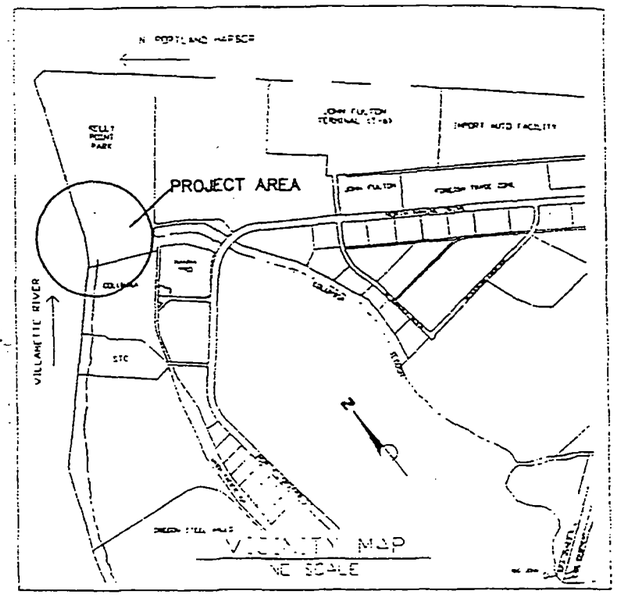
Figure 4

Proposed Sampling Location Plan - Terminal 5

Port of Portland





0 100 200

Scale in Feet

Proposed Dredging Prism

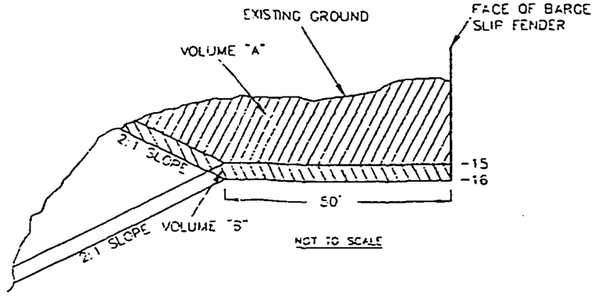
● HC-VC-10 Proposed Sampling Location and Number

VOLUME CALCULATIONS

VOLUME "A"=847 CUBIC YARDS

VOLUME "B"=374 CUBIC YARDS

VOLUME "A" + VOLUME "B"=1221 CUBIC YARDS



1. HORIZONTAL DATUM: ASSUMED

2. CONTOURS ARE SHOWN IN FEET AND INDICATE DEPTHS BELOW COLUMBIA RIVER DATUM ZERO. THE TIDE BOARD USED IS LOCATED KELLY POINT AT THE CONFLUENCE OF THE WILLAMETTE RIVER.

3. HORIZONTAL POSITIONS FOR NAVIGATION AND DATA COLLECTION WERE DETERMINED BY USING A HYDRO-II RANGE-AZIMITH SYSTEM.

4. BATHYMETRIC DATA WERE COLLECTED USING AN INNERSPACE-448 ECHOSOUNDER WITH AN 8° SINGLE BEAM TRANSDUCER.

5. SURVEY DATA WERE COLLECTED LONGITUDINALLY WITH THE DOCK FACE USING A TWENTY-FIVE FOOT LINE SPACING. THE SURVEY DATA COLLECTED ALONG EACH SURVEY LINE WERE THINNED USING A "SHOAL BIAS" METHOD TO AN APPROXIMATE HORIZONTAL SPACING OF 5 FEET.

6. THERE MAY BE BOTTOM FEATURES THAT ARE NOT SHOWN ON THIS MAP BECAUSE OF THE LINE SPACING INTERVAL. THIS SURVEY DOES NOT INCLUDE BATHYMETRIC DATA BETWEEN THE ADJACENT SURVEY LINES.

7. THIS BATHYMETRIC SURVEY IS REPRESENTATIVE OF THE CONDITION OF THE RIVER BOTTOM AT THE TIME OF THE SURVEY BASED ON THE LINE SPACING INTERVAL AND THINNING METHOD USED. THE CONDITION OF THE RIVER BOTTOM MAY CHANGE AT ANY TIME AFTER THE DATE OF THIS SURVEY.

8. HYDROGRAPHIC SURVEY DATA COLLECTED: SEPTEMBER 16, 1996

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Figure 5

Sediment Sampling Form

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Sediment Sampling Form

Project _____ Date _____

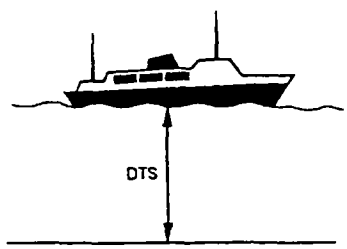
Job No. _____ HC Reps _____

Subcontractor _____ Conditions _____

Sample Location _____ Sample Method _____

Proposed Coordinates N: _____

E: _____



Elevation of Water _____

Tide _____

Elevation of Sediment _____

SAMPLE ACCEPTABILITY CRITERIA:

1. Overlying water is present
2. Water has low turbidity
3. Sampler is not overfilled
4. Surface is flat
5. Desired penetration depth

Run #	Time	Northing	Easting	Sampling Accepted Y/N	Comments (ie: penetration depth, biota, disturbance)

Sediment Description _____

Sample Container Type _____

Volume Filled _____

Analysis _____

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Figure 6

Con\5589\sed_frg

Key for Sediment Logs

Sample Description

Classification of soils in this report is based on visual field and laboratory observations which include density/consistency, moisture condition, grain size, and plasticity estimates and should not be construed to imply field nor laboratory testing unless presented herein. Visual-manual classification methods of ASTM D 2488 were used as an identification guide.

Soil descriptions consist of the following:
Density/consistency, moisture, color, minor constituents, MAJOR CONSTITUENT, additional remarks.

Density/Consistency

Soil density/consistency in borings is related primarily to the Standard Penetration Resistance.
Soil density/consistency in test pits is estimated based on visual observation and is presented parenthetically on the test pit logs.

SAND or GRAVEL Density	Standard Penetration Resistance (N) in Blows/Foot	SILT or CLAY Consistency	Standard Penetration Resistance (N) in Blows/Foot	Approximate Shear Strength in TSF
Very loose	0 – 4	Very soft	0 – 2	<0.125
Loose	4 – 10	Soft	2 – 4	0.125 – 0.25
Medium dense	10 – 30	Medium stiff	4 – 8	0.25 – 0.5
Dense	30 – 50	Stiff	8 – 15	0.5 – 1.0
Very dense	>50	Very stiff	15 – 30	1.0 – 2.0
		Hard	>30	>2.0

Moisture

Dry	Little perceptible moisture
Damp	Some perceptible moisture, probably below optimum
Moist	Probably near optimum moisture content
Wet	Much perceptible moisture, probably above optimum

Minor Constituents

	Estimated Percentage
Not identified in description	0 – 5
Slightly (clayey, silty, etc.)	5 – 12
Clayey, silty, sandy, gravelly	12 – 30
Very (clayey, silty, etc.)	30 – 50

Legends

Surface Sample Acceptability Criteria:

1. Overlying water is present
2. Water has low turbidity
3. Sampler is not overfilled
4. Surface is flat
5. Penetration depth is acceptable

Estimated Percentage of other Minor Constituents

(ie. shells, wood, organics, plastic, metal brick, refuse)

	Estimated Percentage
Dusting	Trace on Surface
Trace	0–5
Moderate	5–20
Substantial	20–50

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Figure 7

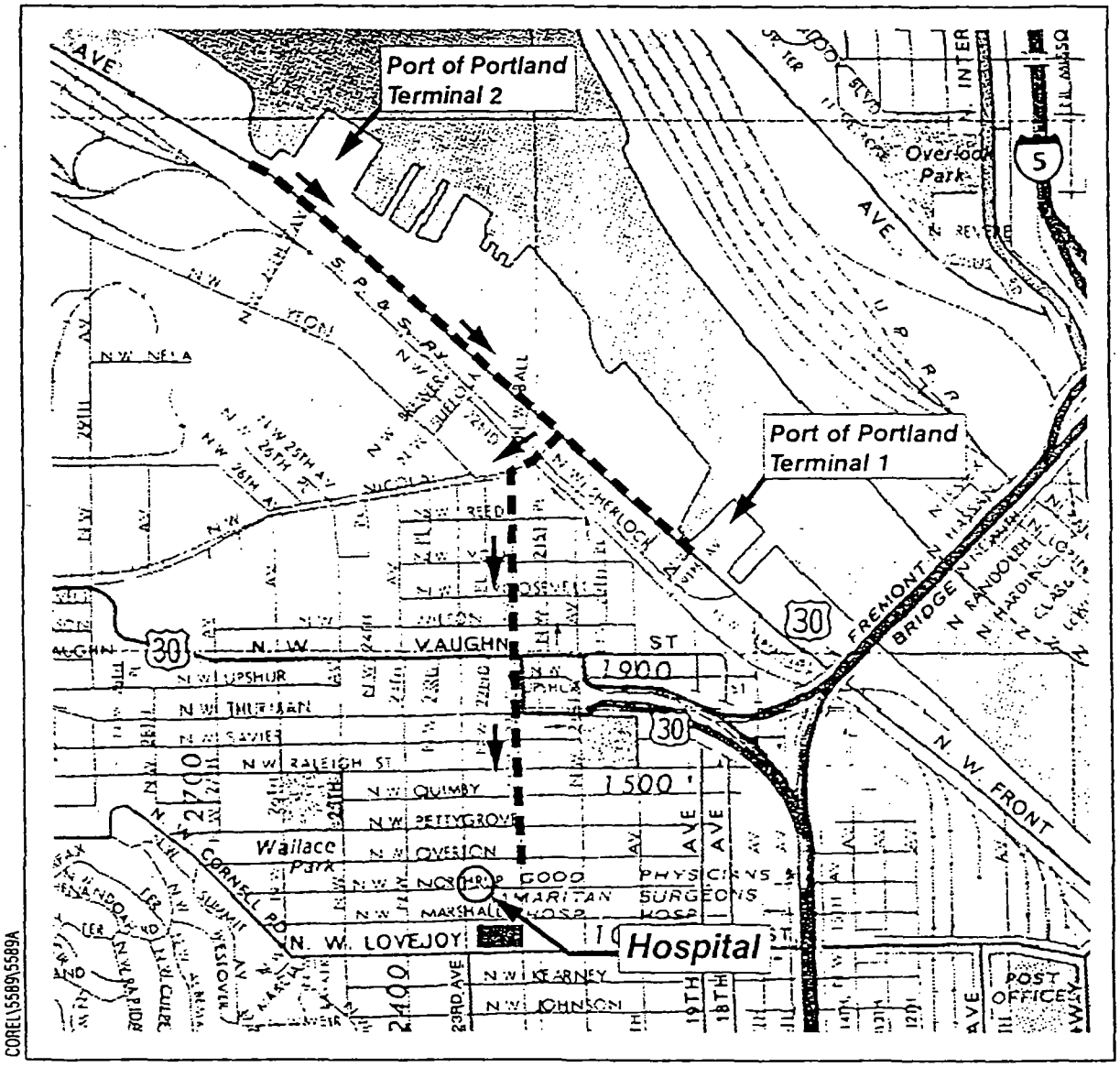
APPENDIX A
HEALTH AND SAFETY PLAN

HEALTH AND SAFETY PLAN
PORT OF PORTLAND - MARINE TERMINALS
PORTLAND, OREGON
DATE PREPARED: October 22, 1996

EMERGENCY CONTINGENCY INFORMATION

SITE LOCATION	Port of Portland - Marine Terminals Terminals 1, 2 and 5 on Willamette River Portland, Oregon
NEAREST HOSPITALS	Good Samaritan Hospital; Emergency Department NW 23rd and NW Northrup (503)229-7260 Bess Kaiser Medical Center 5055 N. Greeley (503)285-9321 The routes to the hospital are depicted on Figures A-1 and A-2.
EMERGENCY RESPONDERS	Police Department ..... 911 Fire Department ..... 911 Ambulance 911
EMERGENCY CONTACTS	Hart Crowser, Portland Office ..... (503)620-7284 Dana Siegfried, Port of Portland Facility Contact ..... (503)731-7323.
IN EVENT OF EMERGENCY, CALL FOR HELP AS SOON AS POSSIBLE	Give the following information: **Where You Are.** Address, cross streets, or landmarks **Phone Number** you are calling from ?? **What Happened.** Type of injury, accident # **How many persons** need help ?? **What is being done** for the victim(s) !! **You hang up last.** Let whomever you called hang up first

Emergency Route to Hospital Map



Good Samaritan Hospital
Emergency Department
NW 23rd and NW Northrup
503-229-7260

0 1/4 1/2
Scale in Miles

N

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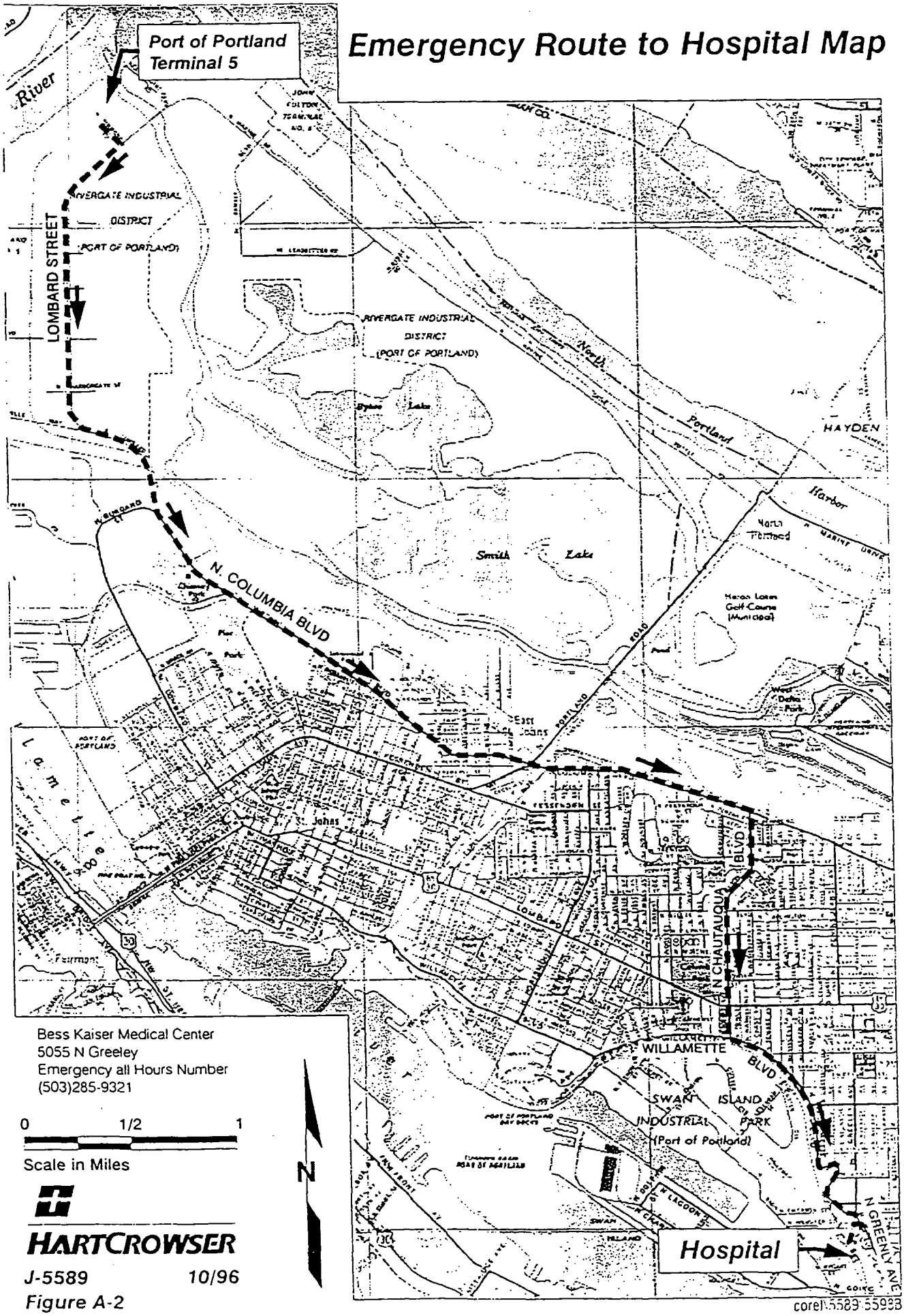
J-5589 10/96
Figure A-1

Emergency Route to Hospital Map



Bess Kaiser Medical Center
5055 N Greeley
Emergency all Hours Number
(503)285-9321

0 1/2 1

Scale in Miles

N

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Figure A-2

corel:5589-55933

SITE HEALTH AND SAFETY PLAN SUMMARY

SITE NAME: Port of Portland - Marine Terminals

LOCATION: Terminals 1, 2, and 5 on Willamette River, Portland, OR
See Figures A-1 and A-2

CLIENT: Port of Portland

PROPOSED DATES OF ACTIVITIES: Approximately October 28 through November 15, 1996

TYPE OF FACILITY: River Terminals

LAND USE OF AREA SURROUNDING FACILITY: Industrial

SITE ACTIVITIES: Collection of Sediment Cores

POTENTIAL SITE CONTAMINANTS: Tributyltin, PAHs, Metals (Pb, As, Ni, Zn)

ROUTES OF ENTRY: Airborne dust; skin contact with sediments and incidental ingestion of soil.

PROTECTIVE MEASURES: Engineering controls, safety glasses, safety boots, hard hat, gloves, protective clothing, and respirators.

MONITORING EQUIPMENT: MSA 361 or equivalent combustible gas, oxygen, and hydrogen sulfide meter

1.0 INTRODUCTION

1.1 Purpose and Regulatory Compliance

This site-specific Health and Safety Plan (H&S Plan) addresses procedures to minimize the risk of chemical exposures, physical accidents to on-site workers, and environmental contamination. The H&S Plan covers each of the 11 required plan elements as specified in 29 CFR 1910.120 or equivalent state regulations. Table A-1 lists the sections of this plan which apply to each of these required elements. When used together with the Hart Crowser General H&S Plan, this site-specific plan meets all applicable regulatory requirements.

Table A-1 - Location of Required Health and Safety Plan Elements in This Site-Specific H&S Plan

Required H&S Plan Element	Section in this Health and Safety Plan
Confined space entry	2.6 Other Physical Hazards
Decontamination	7.0 Decontamination
Emergency response plan	11.0 Emergency Response Plan
Medical surveillance	12.0 Medical Surveillance
Monitoring program	2.3 Air Monitoring and Action Levels
Names of key personnel	1.3 Chain of Command
Personal protective equipment	3.0 Protective Equipment, 4.0 Safety Equipment List
Safety and hazard analysis	2.0 Hazard Evaluation and Control Measures
Site control	5.0 Exclusion Areas, 9.0 Site Security and Control
Spill containment	10.0 Spill Containment
Training	13.0 Training Requirements

1.2 Distribution and Approval

This H&S Plan will be made available to all Hart Crowser personnel involved in field work on this project. It will also be made available to subcontractors and other non-employees who may need to work on the site. For non-employees, it must be made clear that the plan represents minimum safety procedures and that they are responsible for their own safety while present on site. The plan has been approved by the Hart Crowser Corporate Health and Safety (H&S) Manager. By signing the documentation form provided with this plan (Table A-3 located at the end of plan), project workers also certify their approval and agreement to comply with the plan.

1.3 Chain of Command

The chain of command for health and safety on this project involves the following individuals:

Project Manager—Todd Thornburg

The Project Manager has overall responsibility for the successful outcome of the project. The Project Manager, in consultation with the Corporate H&S Manager, makes final decisions regarding questions concerning the

implementation of the site-specific H&S Plan. The Project Manager may delegate this authority and responsibility to the Project and/or Field H&S Managers.

Corporate H&S Manager—David E. Chawes, C.I.H.

The Hart Crowser Corporate H&S Manager has overall responsibility for preparation and modification of this H&S Plan. In the event that health and safety issues arise during site operations, he will attempt to resolve them in discussion with the appropriate members of the project team.

Project H&S Manager—Taku Fuji

The Project H&S Manager has overall responsibility for health and safety on this project. This individual ensures that everyone working on this project understands this H&S Plan. This individual will maintain liaison with the Hart Crowser Project Manager so that all relevant health and safety issues are communicated effectively to project workers.

Field H&S Manager—Taku Fuji

The Field H&S Manager is responsible for implementing this H&S Plan in the field. This individual also observes subcontractors to verify that they are following these procedures, at a minimum. The Field H&S Manager will also assure that proper protective equipment is available and used in the correct manner, decontamination activities are carried out properly, and that employees have knowledge of the local emergency medical system should it be necessary.

1.4 Site Work Activities

The following work task will be accomplished:

Collection of sediment cores.

1.5 Site Description

The site is composed of river freight terminals.

2.0 HAZARD EVALUATION AND CONTROL MEASURES

2.1 Toxicity of Chemicals of Concern

Based on previous site information and knowledge of the types of activities conducted at this location, the following chemicals may be present at this site: tributylin, PAHs, metals (As, Ni, Pb, Zn).

Health hazards of these chemicals are discussed below. This information covers potential toxic effects which might occur if relatively significant acute and/or chronic exposure were to happen. This information does not mean that such effects will occur from the planned site activities. In general, the chemicals, which may be encountered at this site, are not expected to be present at concentrations that could produce significant exposures. The types of planned work activities and use of monitoring procedures and protective measures will limit potential exposures at this site.

These standards are presented using the following abbreviations:

PEL Permissible exposure limit.

TWA Time-weighted average exposure limit for any 8-hour work shift.

STEL Short-term exposure limit expressed as a 15-minute time-weighted average and not to be exceeded at any time during a work day.

Tributyltin

According to the FDA (USFDA), the "symptoms of acute tin toxicity" (to humans) "are nausea, abdominal cramping, diarrhea, and vomiting." These symptoms have often followed consumption of canned fruit juices containing 1,400 ppm tin, canned salmon containing 650 ppm tin, and vodka punch containing 2,000 ppm tin. The latter had been held in a tin can. Based on low intestinal absorption of tin, the acute toxic symptoms are probably primarily the result of local irritation of the gastrointestinal tract. The current PEL for organic tin compounds, as tin, is 0.1 mg/m^3.

Polynuclear Aromatic Hydrocarbons (PAHs)

Exposure to PAHs can occur via inhalation of vapors, ingestion, and skin and eye contact. Skin contact can result in reddening or corrosion. Ingestion can cause nausea, vomiting, blood pressure fall, abdominal pain, convulsions, and coma. Damage to the central nervous system can also occur. The U.S. Department of Health and Human Services (1989) has

classified 15 PAHs compounds as having sufficient evidence for carcinogenicity, while the U.S. EPA (1990) has classified at least 5 of the identified PAHs as human carcinogens. There are no currently assigned PEL-TWA for PAHs, but the closely related material coal tar is listed as coal tar pitch volatiles with a PEL-TWA of 0.2 mg/m^3.

Arsenic

Arsenic is toxic by inhalation and ingestion of dusts and fumes or by inhalation of arsine gas. Trivalent arsenic compounds are the most toxic to humans, with significant corrosive effects on the skin, eyes, and mucous membranes. Dermatitis also frequently occurs, and skin sensitization and contact dermatitis may result from arsenic trioxide or pentoxide. Trivalent arsenic interacts with a number of sulfhydryl proteins and enzymes, altering their normal biological function. Ingestion of arsenic can result in fever, anorexia, cardiac abnormalities, and neurological damage. Liver injury can accompany chronic exposure. Skin and inhalation exposure to arsenic has been associated with cancer in humans, particularly among workers in the arsenical-pesticide industry or copper smelters. The EPA currently classifies arsenic as a Class A, or confirmed, human carcinogen. Arsine is a highly toxic gaseous arsenical, causing nausea, vomiting, and hemolysis. The current PEL-TWA for organic and inorganic forms of arsenic is 0.01 mg/m^3.

Nickel

Nickel exposure can occur via inhalation of dust or fume, ingestion, and eye and skin contact. Nickel and its compounds are irritating to the eye and mucous membranes, and skin exposure frequently leads to sensitization and a chronic eczema referred to as "nickel itch." Elemental nickel and nickel salts are considered probable carcinogens via inhalation, and nickel carbonyl is clearly recognized as a human carcinogen. Animal studies have demonstrated health effects on the kidneys, liver, brain, and heart muscle. The current PEL-TWA for soluble nickel and insoluble nickel are 0.1 and 1.0 mg/m^3, respectively. The PEL-TWA for nickel carbonyl is 0.007 mg/m^3 as nickel.

Lead

Inorganic Lead. Inorganic lead exposure can occur via inhalation of dusts or metal fumes, ingestion of dusts, and skin and eye contact. The principal target organs of lead toxicity include the nervous system, kidneys, blood, gastrointestinal, and reproductive systems. Generalized symptoms of lead exposure include decreased physical fitness, fatigue, sleep disturbances, headaches, bone and muscle pain, constipation, abdominal pain, and

decreased appetite. More severe exposure can result in anemia, severe gastrointestinal disturbance, a "lead-line" on the gums, neurological symptoms, convulsions, and death.

Neurological effects are among the most severe of inorganic lead's toxic effects and vary depending on the age of individual exposed. Effects observed in adults occur primarily in the peripheral nervous system, resulting in nerve destruction and degeneration. Wrist-drop and foot-drop are two characteristic manifestations of this toxicity.

The EPA also currently lists inorganic lead as a Group B2 probable human carcinogen via the oral route. This conclusion is based on feeding studies conducted in laboratory animals. The current PEL-TWA for inorganic lead is 0.05 mg/m^3. Occupational exposure to lead is also specifically regulated under WAC 296-62-07521, with an action level established at 0.03 mg/m^3 that triggers monitoring and other requirements.

Organo-Lead Compounds. The most notable organo-lead compounds are tetraethyl (TEL) and tetramethyl lead (TML). These chemicals are colorless liquids which have been used principally as anti-knock compounds in gasoline. When used as such, they are generally mixed with soluble dyes for identification purposes. In the environment, TEL is reported to decompose under sunlight to form crystals of mono-, di-, and triethyl lead compounds, which have a characteristic garlic-like odor.

TEL and TML can be toxic via inhalation, ingestion, percutaneous absorption, and skin and eye contact. Major target organs include the kidneys and the nervous, gastrointestinal, and cardiovascular systems. TEL is irritating to the eyes, and its decomposition products may be inhaled as dust, leading to irritation of the upper respiratory tract and convulsive sneezing. The dusts may also cause itching, burning, and redness of eyes and mucous membranes.

TEL and TML are also readily absorbed into the nervous system and are considerably more neurotoxic than inorganic lead. Minor intoxication by TEL or TML can result in nervous excitation, insomnia, and gastrointestinal symptoms. The most notable symptom of TEL poisoning and repeated exposure is encephalopathy (disease of the brain), characterized by symptoms of anxiety, delirium with hallucinations, delusions, convulsions, and acute psychosis. In contrast to inorganic lead intoxication, peripheral nerve damage is not observed. The current PEL-TWA for both TEL and TML is 0.075 mg/m^3 as lead.

Zinc

Zinc compounds can be hazardous by inhalation of dust and fumes, ingestion, and skin and eye contact. Zinc chloride is corrosive to skin and mucous membranes, and sensitization can occur resulting in dermatitis. Eye contact can produce inflammation and corneal ulceration. Ingestion can result in corrosive damage to the digestive tract. The current PEL-TWA for exposure to zinc chloride fume is 1 mg/m^3. Zinc chromate exhibits potential carcinogenic effects and is currently limited with a PEL-TWA of 0.05 mg/m^3. Zinc oxide is toxic via inhalation of fumes and dusts and may cause dermatitis. The current PEL-TWA for zinc oxide is 10 mg/m^3 as total dust and 5 mg/m^3 as the respirable fraction.

2.2 Potential Exposure Routes

Inhalation

Exposure via this route could occur if dusts become airborne during site activities. This is unlikely given the wet nature of the sediment cores.

Skin Contact

Exposure via this route could occur if contaminated sediments contact the skin or clothing. Protective clothing and decontamination activities specified in this plan will minimize the potential for skin contact with the contaminants.

Ingestion

Exposure via this route could occur if individuals eat, drink or perform other hand-to-mouth contact in the contaminated (exclusion) zones. Decontamination procedures established in this plan will minimize the inadvertent ingestion of contaminants.

2.3 Air Monitoring and Action Levels

Air monitoring will not be conducted based on the low potential for airborne dusts.

2.4 Fire and Explosion Hazard

Potentially explosive conditions are unlikely to be encountered. Field monitoring equipment will not be necessary to determine the percent of the lower explosive limit (LEL).

An ABC dry chemical fire extinguisher with a minimum charge of 10 pounds shall be a part of the sampling equipment brought to the site. Observe basic precautions such as no smoking or creation of sparks or open flames.

2.5 Cold Stress

Cold stress, or hypothermia, can result from abnormal cooling of the core body temperature.

Signs of Hypothermia

Hypothermia can result from abnormal cooling of the core body temperature. It is caused by exposure to a cold environment, and wind-chill as well as wetness or water immersion can play a significant role. The following discusses signs and symptoms as well as treatment for hypothermia.

Typical warning signs of hypothermia include fatigue, weakness, incoordination, apathy, and drowsiness. A confused state is a key symptom of hypothermia. Shivering and pallor are usually absent, and the face may appear puffy and pink. Body temperatures below 90° F require immediate treatment to restore temperature to normal.

Treatment of Hypothermia

Current medical practice recommends slow rewarming as treatment for hypothermia, followed by professional medical care. This can be accomplished by moving the person into a sheltered area and wrapping with blankets in a warm room. In emergency situations where body temperature falls below 90° F and heated shelter is not available, use a sleeping bag, blankets and/or body heat from another individual to help restore normal body temperature.

2.6 Other Physical Hazards

Trips/Falls

As with all field work sites, caution will be exercised to prevent slips on rain slick surfaces, stepping on sharp objects, etc. Care will be taken not to fall off the boat.

Noise

Appropriate hearing protection (ear muffs or ear plugs with a noise reduction rating of at least 25 dB) will be used for individuals working near an active drill rig or other high-noise generating equipment.

2.7 Hazard Analysis and Applicable Safety Procedures by Task

The work tasks and associated hazards, which may be anticipated during the operations described elsewhere in this work plan, and suitable control measures are presented in Table A-2.

Table A-2 - Hazard Analysis by Task

Work Task	Hazards	Protective Measures
Site reconnaissance	None anticipated	Level D PPE
Sample collection	Splashes, skin contact, inhalation	Level D PPE

Soil, Surface Water, and Groundwater Sampling

All sampling activities will be conducted under the assumption that the media is contaminated and appropriate personnel protection will be required.

3.0 PROTECTIVE EQUIPMENT

Workers performing general site activities where skin contact with free product or contaminated materials is not likely and inhalation risks are not expected will wear regular work clothes or rain suit, eye protection, hard hat, nitrile or neoprene-coated work gloves (as required), and safety boots.

4.0 SAFETY EQUIPMENT LIST

The following Safety Equipment must be available on site:

- Fire Extinguisher - 10 lb ABC
- First Aid Kit
- Eye Wash Kit

- Mobile Telephone
- Hard Hat
- PVC (or similar) rainsuit
- Neoprene Steel-Toed Boots
- Neoprene Outer Gloves/Nitrile or Latex Inner Gloves

5.0 EXCLUSION AREAS

If migration of chemicals from the work area is a possibility, or as otherwise required by regulations or client specifications, site control will be maintained by establishing clearly identified work zones. These will include the exclusion zone, contaminant reduction zone, and support zone, as discussed below.

5.1 Exclusion Zone

Exclusion zones will be established around the sample collection work area on the boat. Only persons with appropriate training and authorization from the Field H&S Manager will enter this area while work is being conducted there.

5.2 Contamination Reduction Zone

A contamination reduction zone will be established just outside the temporary exclusion zone to decontaminate equipment and personnel as discussed below. This zone will be clearly delineated from the exclusion zone and support zone. Care will be taken to prevent the spread of contamination from this area.

5.3 Support Zone

A support zone will be established outside the contamination reduction area to stage clean equipment, don protective clothing, take rest breaks, etc. This zone will be clearly delineated from the contaminant reduction zone using the means noted above.

6.0 MINIMIZATION OF CONTAMINATION

In order to make the work zone procedure function effectively, the amount of equipment and number of personnel allowed in contaminated areas must be minimized. In addition, the amounts of soil, water, or other media collected should not exceed what is needed for laboratory analysis and record samples.

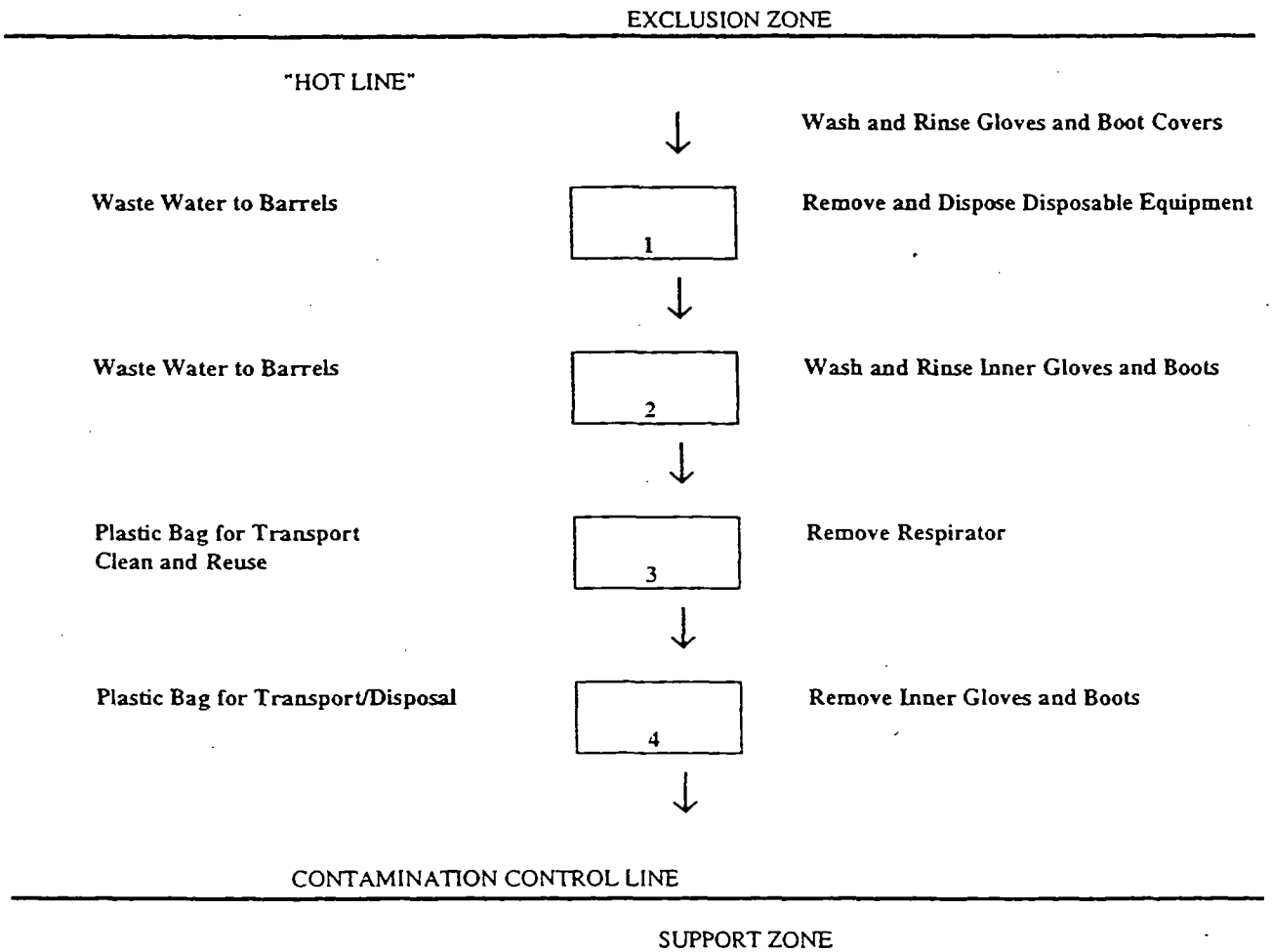
Do not kneel on contaminated ground, stir up unnecessary dust, or perform any practice that increases the probability of hand-to-mouth transfer of contaminated materials. Use plastic drop cloths and equipment covers where appropriate. Eating, drinking, chewing gum, smoking, or using smokeless tobacco are forbidden in the exclusion zone.

7.0 DECONTAMINATION

Decontamination is necessary to limit the migration of contaminants from the work zone(s) onto the site or from the site into the surrounding environment. Figure A-3 presents a layout for conducting decontamination within the sites zones discussed previously. Equipment and personnel decontamination are discussed in the following sections, and the following types of equipment will be available to perform these activities:

- Boot and Glove Wash Bucket and Rinse Bucket
- Scrub Brushes - Long Handled
- Spray Rinse Applicator
- Plastic Garbage Bags
- 5-Gallon Container Alkaline Decon Solution

Figure A-3 - Decontamination Layout



7.1 Equipment Decontamination

Proper decontamination (decon) procedures will be employed to ensure that contaminated materials do not contact individuals and are not spread from the site. These procedures will also ensure that contaminated materials generated during site operations and during decontamination are managed appropriately.

All non-disposable equipment will be decontaminated in the contamination reduction zone. Prior to demobilization, all contaminated portions of heavy equipment should be thoroughly cleaned. Heavy equipment may require steam cleaning. Soil and water sampling instruments should be cleaned with detergent solutions in portable buckets.

7.2 Personnel Decontamination

Personnel working in exclusion zones will perform decontamination in the contamination reduction zone prior to taking rest breaks, drinking liquids, etc. The following describes the procedures for decon activities.

Mini-decon Procedure:

1. In the contamination reduction zone, wash and rinse gloves and boots in portable buckets.
2. Remove protective suit.
3. Remove work boot and gloves. Inspect and discard if ripped or damaged.
4. Remove respirator (if worn) and clean off sweat and dirt using premoistened towelettes. Deposit used cartridges in plastic bag.

Full Decontamination Procedure:

1. In the contamination reduction zone, wash and rinse outer gloves and boots in portable buckets.
2. Remove outer gloves and protective suit and deposit in labeled container for disposable clothing.
3. Remove respirator, and place used respirator cartridges (if end of day) in container for disposable clothing.
4. If end of day, thoroughly clean respirator and store properly.
5. Remove inner gloves and discard into labeled container for disposable clothing.
6. Remove work boots without touching exposed surfaces, and put on street shoes. Put boots in individual plastic bag for later reuse.
7. Immediately wash hands and face using clean water and soap.

8. Shower as soon after work shift as possible.

8.0 DISPOSAL OF CONTAMINATED MATERIALS

All disposable sampling equipment and materials will be placed inside of a 6 mil polyethylene bag or other appropriate container. Disposable supplies will be removed from the site with the personnel.

9.0 SITE SECURITY AND CONTROL

Site security and control will be the responsibility of the Project Manager. The "buddy-system" will be used when working in designated hazardous areas. Any security or control problems will be reported to appropriate authorities.

10.0 SPILL CONTAINMENT

Sources of bulk chemicals subject to spillage are not expected to be encountered in this project. Accordingly, spill containment plan is not required for this project.

11.0 EMERGENCY RESPONSE PLAN

The Hart Crowser Emergency Response Plan outlines the steps necessary for appropriate response to emergency situations. The following paragraphs summarize the key Emergency Response Plan procedures for this project.

11.1 Plan Content and Review

The principal hazards addressed by the Emergency Response Plan include the following: fire or explosion, medical emergencies, uncontrolled contaminant release, and situations such as the presence of chemicals above exposure guidelines or inadequate protective equipment for the hazards present. However, in order to help anticipate potential emergency situations, field personnel shall always exercise caution and look for signs of potentially hazardous situations, including the following as examples:

- Visible or odorous chemical contaminants;
- Drums or other containers;
- General physical hazards, slippery or uneven surfaces, etc.);

- Live electrical wires or equipment;
- Underwater pipelines or cables; and
- Dangerous marine animals.

These and other potential problems should be anticipated and steps taken to avert problems before they occur.

The Emergency Response Plan shall be reviewed and rehearsed, as necessary, during the on-site health and safety briefing. This ensures that all personnel will know what their duties shall be if an actual emergency occurs.

11.2 Plan Implementation

The Field H&S Manager shall act as the lead individual in the event of an emergency situation and evaluate the situation. He/she will determine the need to implement the emergency procedures, in concert with other resource personnel including client representatives, the Project Manager, and the Corporate H&S Manager. Other on-site field personnel will assist the Field H&S Manager as required during the emergency.

In the event that the Emergency Response Plan is implemented, the Field H&S Manager or designee is responsible for alerting all personnel at the affected area by use of a signal device (such as a hand-held air horn) or visual or shouted instructions, as appropriate.

Emergency evacuation routes and safe assembly areas shall be identified and discussed in the on-site health and safety briefing, as appropriate. The buddy-system will be employed during evacuation to ensure safe escape, and the Field H&S Manager shall be responsible for roll call to account for all personnel.

11.3 Emergency Response Contacts

Site personnel must know whom to notify in the event of Emergency Response Plan implementation. The following information will be readily available at the site in a location known to all workers:

- Emergency Telephone Numbers: see list at the beginning of this plan;
- Route to Nearest Hospital: see list and route maps (Figure A-1 and A-2) at the beginning of this plan;
- Site Descriptions: see the description at the beginning of this plan; and

- If a significant environmental release of contaminants occurs, the federal, state, and local agencies noted in this plan must be immediately notified. If the release to the environment includes navigable waters also notify:

  - National Response Center at (800) 424-8802
  - EPA at (908) 321-6660

In the event of an emergency situation requiring implementation of the Emergency Response Plan (fire or explosion, serious injury, tank leak or other material spill, presence of chemicals above exposure guidelines, inadequate personnel protection equipment for the hazards present, etc.), cease all work immediately. Offer whatever assistance is required, but do not enter work areas without proper protective equipment. Workers not needed for immediate assistance will decontaminate per normal procedures (if possible) and leave the work area, pending approval by the Field H&S Manager for restart of work. The following general emergency response safety procedures should be followed.

11.4 Fires

Hart Crowser personnel will attempt to control only very small fires. If an explosion appears likely, evacuate the area immediately. If a fire occurs which cannot be controlled with the 10-pound ABC fire extinguisher located in the field equipment, then immediate intervention by the local fire department or other appropriate agency is imperative. Use these steps:

- Evacuate the area to a previously agreed upon, upwind location;
- Contact fire agency identified in the site specific plan; and
- Inform Project Manager or Field H&S Manager of the situation.

11.5 Medical Emergencies

Contact the agency listed in the site-specific plan if a medical emergency occurs. If a worker leaves the site to seek medical attention, another worker should accompany the patient. When in doubt about the severity of an accident or exposure, always seek medical attention as a conservative approach. Notify the Project Manager of the outcome of the medical evaluation as soon as possible. For minor cuts and bruises, an on-site first aid kit will be available.

- If a worker is seriously injured or becomes ill or unconscious, immediately request assistance from the emergency contact sources noted in the site-specific plan. Do not attempt to assist an unconscious

worker in an untested or known dangerous confined space without applying confined space entry procedures or without using proper respiratory protection, such as a self contained breathing apparatus (SCBA).

- In the event that a seriously injured person is also heavily contaminated, use clean plastic sheeting to prevent contamination of the inside of the emergency vehicle. Less severely injured individuals may also have their protective clothing carefully removed or cut off before transport to the hospital.

11.6 Uncontrolled Contaminant Release

In the event of a hazardous material spill, attempt to stop and contain the flow of material using absorbents, booms, dirt, or other appropriate material. Prevent migration of liquids into streams or other bodies of water by building trenches, dikes, etc. Drum the material for proper disposal or contact a spill removal firm for material cleanup and disposal, as required. Observe all fire and explosion precautions while dealing with spills.

11.7 Potentially High Chemical Exposure Situations/Inadequate Protective Equipment

In some emergency situations, workers may encounter localized work areas where exposure to previously unidentified chemicals could occur. A similar hazard includes situations where chemicals are present above permissible exposure levels and/or above the levels suitable for the personnel protective equipment at hand on-site. If these situations occur, immediately stop work and evacuate the work area. Do not reenter the area until appropriate help is available and/or appropriate personnel protective equipment is obtained. Do not attempt to rescue a downed worker from such areas without employing confined space entry procedures. Professional emergency response assistance (fire department, HAZMAT team, etc.) may be necessary to deal with this type of situation.

11.8 Other Emergencies

Depending on the type of project, other emergency scenarios may be important at a specific work site. These scenarios will be considered as part of the site-specific plan and will be discussed during the on-site safety briefing, as required.

11.9 Plan Documentation and Review

The Field H&S Manager will notify the Project H&S Manager as soon as possible after the emergency situation has been stabilized. The Project Manager or H&S Manager will notify the appropriate client contacts, and regulatory agencies, if applicable. If an individual is injured, the Field H&S Manager or designate will file a detailed Accident Report with the Corporate H&S Manager within 24 hours.

The Project Manager and the Field, Project, and Corporate H&S Managers will critique the emergency response action following the event. The results of the critique will be used in follow-up training exercises to improve the Emergency Response Plan.

12.0 MEDICAL SURVEILLANCE

A medical surveillance program has been instituted for Hart Crowser employees having exposure to hazardous substances. Exams are given before assignment, annually thereafter, and upon termination. Content of exams is determined by the Occupational Medicine physician in compliance with applicable regulations and is detailed in the General H&S Plan.

Each team member will have undergone a physical examination as noted above in order to verify that he/she is physically able to use protective equipment, work in hot environments, and not be predisposed to occupationally induced disease. Additional exams may be needed to evaluate specific exposures or unexplainable illness.

13.0 TRAINING REQUIREMENTS

Hart Crowser employees who perform site work must understand potential health and safety hazards. All employees potentially exposed to hazardous substances, health hazards, or safety hazards will have completed 40 hours of off-site initial hazardous materials health and safety training or will possess equivalent training by past experience. They will also have a minimum of three days of actual field experience under the direct supervision of a trained supervisor. All employees will have in their possession evidence of completing this training. Employees will also complete annual refresher, supervisor, and other training as required by applicable regulations.

Prior to the start of each work day, the Field H&S Manager will review applicable health and safety issues with all employees and subcontractors

working on the site, as appropriate. These briefings will also review the work to be accomplished, with an opportunity for questions to be asked.

14.0 REPORTING, REPORTS, AND DOCUMENTATION

The Field Health and Safety Report will be completed daily by the Hart Crowser Field Health and Safety Manager or designated individual. In the event that accidents or injuries occur during site work, the Project Manager will be informed, who will notify the client immediately. Hart Crowser staff and subcontractors on this site will sign the Record of H&S Communication document (Table A-3), which will be kept on site during work activities and recorded in the project files.

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Table A-3 - Record of Health and Safety Communication*

PROJECT NAME:	
SITE CONTAMINANTS:	

PPE REQUIREMENTS (check all that apply):

X Safety glasses	X Gloves (specify)	_____
X Safety boots	X Clothing (specify)	_____
X Hard hat	__Respirator (specify)	_____
	__Other (specify)	_____

The following personnel have reviewed a copy of the Site-specific Health and Safety Plan. By signing below, these personnel indicate that they have read the plan, including all referenced information, and that they understand the requirements which are detailed for this project.

PRINTED NAME	SIGNATURE	PROJECT DUTIES	DATE

*PROJECT MANAGER: PLEASE ROUTE A COPY OF THIS FORM TO THE CORPORATE H&S MANAGER WHEN COMPLETED.

Seattle Job File

Sediment Characterization Study
River Terminals 1, 2, and 5
Willamette River

Prepared for
Port of Portland
Portland, Oregon

January 14, 1997
J-5589

CONTENTS

TABLES

FIGURES

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ACRONYMS

Corps	Army Corps of Engineers - Portland District
CRD	Columbia River Datum
DMMU	Dredge Material Management Unit
PSDDA	Puget Sound Dredge Disposal Analysis
SAP	Sampling and Analysis Plan
TBT	Tributyltin

SEDIMENT CHARACTERIZATION STUDY
RIVER TERMINALS 1, 2, AND 5
WILLAMETTE RIVER, OREGON

1.0 INTRODUCTION

1.1 Project Background

This report presents the results of a sediment characterization study conducted at the River Terminals 1, 2, and 5 for the Port of Portland (see vicinity map and location maps, Figures 1 through 5). This work was authorized by the Port of Portland to support proposed maintenance dredging activities at these terminals to remove accumulated sediment which is currently above target berthing depths. The purpose of this work was to assess the quality of the proposed dredge prisms at these river terminals to determine appropriate sediment disposal options.

At Terminal 1, maintenance dredging is proposed along Berth 104 to maintain berth elevation of -25 feet below Columbia River Datum (CRD) and is expected to remove approximately 7,897 cubic yards of material from the mooring area. At Terminal 2, maintenance dredging is proposed for Berths 204, 205, and 206, to maintain berth elevation of -40 feet CRD and would remove approximately 10,053 cubic yards of material from the mooring area. At Terminal 5, maintenance dredging is proposed for the barge slip to maintain berth elevation of -15 feet CRD and would remove approximately 1,221 cubic yards of material from the barge slip. Estimated total dredging quantity for the three terminals is approximately 19,261 cubic yards including one foot of overdredge.

1.2 Report Organization

The main body of the report discusses the results of the sediment characterization study and the dredge material disposal options based upon comparison with Puget Sound Dredge Disposal Analysis (PSSDA) screening levels. Supporting discussions within the text include sediment sampling locations and any modifications to the agency-approved Sampling and Analysis Plan (Hart Crowser October 22, 1996). The attached appendices present supporting information including chemical testing data (Appendix A) and sediment core logs (Appendix B). Additional procedural details are

presented in the Sampling and Analysis Plan (Hart Crowser October 22, 1996) that guided this work.

2.0 SEDIMENT SAMPLING AND HANDLING

All sediment sampling and handling activities were performed in accordance with the agency-approved Sampling and Analysis Plan (Hart Crowser, October 22, 1996). These procedures included methods for locating the sediment sampling locations, coring of the sediments, and compositing the material for analysis. All modifications to the Sampling and Analysis Plan are detailed in subsequent sections of this report.

2.1 Sampling Locations and Methods

Sediment cores were collected from each of the locations shown on Figures 3 through 5 on November 12 and 13, 1996. Table 1 presents the coordinates of the sampling locations, the depth to sediment (in feet CRD) at the time of sampling, and the depth of the collected sediment core. Individual sediment core descriptions are included in the Sediment Core Logs presented in Appendix B.

2.2 Modifications to the Sampling and Analysis Plan

There were several changes that were made in the sediment sampling protocol presented in the Sampling and Analysis Plan (SAP) because of difficult field conditions. The main deviation from the SAP involved the type of sampling device deployed to collect the sediment cores. Because of the difficulties experienced by the field crew collecting acceptable sediment cores using the small vibracore that was initially proposed in the SAP, a gravity core (6-foot barrel, 4-inch-diameter core) was successfully used for sediment collection efforts except at one location, as described below.

The coarse and compact sediment at location HC-SS-9 at Terminal 5, which was over 99 percent sand, resulted in several unsuccessful recovery attempts using the gravity core. As was discussed with Dana Siegfried of the Port of Portland and Mark Siipola of the Corps on November 13, 1996, a surface sample was collected at this location using a Ponar grab sampler in lieu of a core. The actual sampling location for HC-SS-9 was also offset slightly from the proposed location because access was restricted by a grain barge moored at the berth.

Access to the initially proposed sampling locations at Berth 104 at Terminal 1 was obstructed by a moored vessel. Because of this access restriction, sediment cores HC-GC-01 and HC-GC-02 were collected in areas with a higher river bed elevation than was initially expected. Although the cores were collected to the maximum depth possible with the gravity core (5 to 6 foot cores), these cores are nevertheless a few feet shy of the maximum target depth of the dredging prism (-26 feet CRD; see Table 1). However, an examination of these cores did not show significant stratification (see sediment core logs Appendix B); thus, we believe that the entire dredge prism can be assumed to be reasonably homogeneous, and the cores should be representative of the deeper interval.

2.3 Data Quality Review

A standard data quality review was performed by Hart Crowser on the analytical data package submitted by Columbia Analytical Services and is included as Appendix A of this report. The data quality review concluded that the chemistry data are acceptable for evaluation of sediment disposal options.

3.0 COMPARISON OF CHEMISTRY RESULTS WITH PSDDA SCREENING LEVELS

Sediment chemistry results for the proposed dredging prisms at Terminals 1, 2, and 5 are compared to sediment screening levels set forth in the Puget Sound Dredged Disposal Analysis (PSDDA) program for the evaluation of the suitability for open-water disposal. In general, if the concentration of all the detected compounds from a DMMU are below the corresponding screening level, the material from the DMMU is suitable for unconfined open-water disposal. Sediment chemistry results and screening level comparisons are summarized in Table 2.

DMMU T1/B104. Sediments from DMMU T1/B104 (sediment samples HC-T1-01 and HC-T1-02) were determined to be suitable for open-water disposal as all detected compounds were at concentrations below corresponding PSDDA screening levels.

DMMU T2/B204. Sediments from DMMU T2/B204 (sediment sample HC-T2-01) were determined to be suitable for open-water disposal as all detected compounds were at concentrations below corresponding PSDDA screening levels.

DMMU T2/B205. Sediments from DMMU T2/B205 (sediment sample HC-T2-02) were determined to be suitable for open-water disposal as all detected compounds were at concentrations below corresponding PSDDA screening levels.

DMMU T2/B206. Sediments from DMMU T2/B206 (sediment sample HC-T2-03) were determined to be suitable for open-water disposal as all detected compounds were at concentrations below corresponding PSDDA screening levels.

DMMU T5. In sediments from DMMU T5 (sediment samples HC-T5-01 and HC-T5-02), detected compounds were below corresponding PSDDA screening levels with the exception of TBT. The PSDDA screening level for TBT (73 ug/kg TBT) was exceeded in Sample HC-T5-02 (190 ug/kg TBT). Although this sample exceeds the TBT screening level, the material from DMMU T5 may still be appropriate for open-water disposal for the following reasons:

- Because of gravity core rejection, this sample was collected as a surface grab representing only the top six inches of sediment. The sample was collected from a shallow part of the berth, directly adjacent to a moored grain barge, and consists of 99 percent sand. Thus, the TBT is probably not indicative of intrinsic sediment contamination, but rather it appears to be a restricted surficial deposit which is likely derived from touch-down of barges as they load and unload their cargo.

- The 2-foot sediment core collected at Terminal 5 (sample HC-T5-01) is more representative of the dredge prism, and contained a TBT concentration (15 ug/kg TBT) that was less than one-tenth of the concentration found in the surface sample. This observation provides further evidence that the anomalous TBT concentration in HC-T5-02 is surficial in nature and not representative of the DMMU.

- The concentration of all other compounds detected in the two sediment samples from Terminal 5 were well below corresponding PSDDA screening levels. It was initially proposed in the SAP that these two samples be composited as the volume of dredge material in this DMMU is very low (approximately 1,220 cubic yards) but because of the difficulty experienced in collecting sample HC-T5-02, and the different sampling method used, the samples were submitted and analyzed separately. If these samples had been composited together, the

concentration of TBT for sediment from this DMMU would have been closer to 100 ug/kg TBT i.e., very close to the PSDA screening level.

- Based on our experience in Puget Sound, in particular at the Harbor Island Superfund site in Seattle, TBT concentrations similar to those observed in HC-T5-02 routinely pass bioassay testing.

4.0 LIMITATIONS

Work for this project was performed, and this report prepared, in accordance with generally accepted professional practices for the nature and conditions of the work completed in the same or similar localities, at the time the work was performed. It is intended for the exclusive use of the Port of Portland in its submittal to the Corps of Engineers and the Oregon Department of Environmental Quality for specific applications to the referenced properties. This report is not meant to represent a legal opinion. No other warranty, express or implied, is made. Any questions regarding our work and this report, the presentation of the information, and the interpretation of the data are welcome and should be referred to the undersigned.

We trust that this report meets your needs.

Sincerely,

HART CROWSER, INC.

TAKU FUJI
Project Toxicologist

TODD THORNBURG, Ph. D.
Associate Oceanographer

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Table 1 -Willamette River Sediment Sampling Locations, Depths, and Identification

Sediment Core Location	Easting Coordinate	Northing Coordinate	Proposed Core Bottom Elev. in Feet (CRD)	Depth to Sediment in Feet (CRD)	Core Depth in Feet	DMMU Identification	Sample Identification	Approx. DMMU Volume in Cubic Yards
TERMINAL 1								
HC-GC-01	7641209.41	690785.51	-26	-13.2	5.5	T1/B104	HC-T1-01	3,990
HC-GC-02	7641554.34	690425.95	-26	-15	5		HC-T1-02	
TERMINAL 2								
HC-GC-03	7638109.33	694317.98	-41	-37.6	2	T2/B204	HC-T2-01	3,400
HC-GC-04	7638385.2	694034.55	-41	-38.9	2		HC-T2-01	
HC-GC-05	7638663.32	693783.25	-41	-36.8	4	T2/B205	HC-T2-02	3,400
HC-GC-06	7638969.99	693495.1	-41	-37	4		HC-T2-02	
HC-GC-07	7639257.33	693220.98	-41	-37.3	4	T2/B206	HC-T2-03	3,400
HC-GC-08	7639537.5	692958.61	-41	-35.8	4		HC-T2-03	
TERMINAL 5								
HC-SS-09	7621132.85	728384.44	-16	-13.8	6" Grab	T5	HC-T5-02	1,220
HC-GC-10	7620829.27	728163.76	-16	-13	2		HC-T5-01	

5589/PORTABL2.xls

Table 2 - Analytical Results for Sediment Samples

	PSDDA Scr. Level	Terminal 1 HC-T1-01	Terminal 1 HC-T1-02	Terminal 2 HC-T2-01	Terminal 2 HC-T2-02
Grain Size in Percent					
Gravel		0.01	0.08	0.95	0.02
Sand		24.78	28.34	27.27	34.39
Silt		63.30	65.50	66.70	61.40
Clay		11.50	7.59	8.22	7.63
Conventionals in mg/kg					
Ammonia as Nitrogen		270	360	180	200
Sulfide, Total		1.1 J	2.6 J	0.9 J	1.2 J
Conventionals in percent					
Total Organic Carbon		2.61	2.52	2.18	2.20
Total Solids		49.1	47.6	49.2	49.3
Total Volatile Solids		7.28	7.37	6.62	6.68
Metals in mg/kg					
Arsenic	57	4	4	4	4
Cadmium	0.96	0.18	0.17	0.16	0.16
Copper	81	34.5	34.0	32.7	31.2
Lead	66	15.6	15.8	13.9	13.5
Mercury	0.21	0.08 J	0.07 J	0.07 J	0.06 J
Nickel	140	23	22.7	19.8	21.6
Silver	1.2	0.20	0.22	0.16	0.15
Zinc	160	81.0	81.3	72.3	73.8
Butyltins in µg/kg					
Tributyltin	73	13	8	10	20
Dibutyltin		2	1 U	1 U	1 U
Tetra-n-butyltin		1 U	1 U	1 U	1 U
Pesticide/PCBs in µg/kg					
Alpha-BHC		2 U	2 U	2 U	2 U
Beta-BHC		2 U	2 U	2 U	2 U
Gamma-BHC(Lindane)	10	2 U	2 U	2 U	2 U
Delta-BHC		2 U	2 U	2 U	2 U
Heptachlor	10	2 U	2 U	2 U	2 U
Aldrin	10	2 U	2 U	2 U	2 U
Heptachlor Epoxide		2 U	2 U	2 U	2 U
Endosulfan I		2 U	2 U	2 U	2 U
Dieldrin	10	2 U	2 U	2 U	2 U
4,4'-DDE		2 U	2 U	2 U	2 U
Endrin		2 U	2 U	2 U	2 U
Endosulfan II		2 U	2 U	2 U	2 U
4,4'-DDD		2 U	2 U	2 U	2 U
Endrin Aldehyde		2 U	2 U	2 U	2 U
Endosulfan Sulfate		2 U	2 U	2 U	2 U
4,4'-DDT		2 U	2 U	2 U	2 U
Total DDT	6.9	2 U	2 U	2 U	2 U
Methoxychlor		4 U	4 U	7 U	4 U

Table 2 - Analytical Results for Sediment Samples

	PSDDA Scr. Level	Terminal 1 HC-T1-01	Terminal 1 HC-T1-02	Terminal 2 HC-T2-01	Terminal 2 HC-T2-02
Toxaphene		30 U	30 U	30 U	30 U
Chlordane	10	10 U	10 U	10 U	10 U
Aroclor 1016		10 U	10 U	10 U	10 U
Aroclor 1221		10 U	10 U	10 U	10 U
Aroclor 1232		10 U	10 U	10 U	10 U
Aroclor 1242		10 U	10 U	10 U	10 U
Aroclor 1248		10 U	10 U	10 U	10 U
Aroclor 1254		10 U	10 U	10 U	10 U
Aroclor 1260		10 U	10 U	10 U	10 U
Total PCBs	130	10 U	10 U	10 U	10 U
PAHs in µg/kg					
Total LPAHs	610	89	20	34	36
Naphthalene	210	10 U	10 U	10 U	10 U
Acenaphthylene	64	10 U	10 U	10 U	10 U
Acenaphthene	63	19	10 U	10 U	10 U
Fluorene	64	14	10 U	10 U	10 U
Phenanthrene	320	56	20	34	36
Anthracene	130	10 U	10 U	10 U	10 U
2-Methylnaphthalene	67	10 U	10 U	10 U	10 U
Total HPAHs	1800	284	198	351	347
Fluoranthene	630	57	32	59	71
Pyrene	430	57 J	35 J	59 J	77 J
Benzo(a)anthracene	450	27	19	38	26
Chrysene	670	35	29	48	34
Total Benzofluoranthenes	800	43	35	61	46
Benzo(a)pyrene	680	25	18	36	33
Indeno(1,2,3-c,d)pyrene	69	19	14	25	29
Dibenz(a,h)anthracene	120	10 U	10 U	10 U	10 U
Benzo(g,h,i)perylene	540	21	16	25	31
Phenols in µg/kg					
Phenol	120	50 U	50 U	50 U	
2-Methylphenol	20	50 U	50 U	50 U	
3/4-Methylphenol	120	50 U	50 U	50 U	
2,4-Dimethylphenol	29	50 U	50 U	50 U	
Pentachlorophenol	100	50 U	50 U	50 U	

J - Estimated Concentration

U - Not detected at indicated detection limit.

5589\TBL-2.XLS

Table 2 - Analytical Results for Sediment Samples

	PSDDA Scr. Level	Terminal 2 HC-T2-02 Dup	HC-T2-03	Terminal 5 HC-T5-01	HC-T5-02
Grain Size in Percent					
Gravel		0.02	0.59	0.44	1.25
Sand		33.40	41.89	86.25	99.28
Silt		60.60	46.10	13.00	1.75
Clay		7.51	8.57	3.50	0.56
Conventionals in mg/kg					
Ammonia as Nitrogen		200	190	35	4.8
Sulfide, Total		3.2 J	11 J	ND UJ	ND UJ
Conventionals in percent					
Total Organic Carbon		2.10	1.92	0.53	0.52
Total Solids		49.4	55.6	67.7	72.9
Total Volatile Solids		6.19	5.76	4.30	2.00
Metals in mg/kg					
Arsenic	57	4	3	3	3
Cadmium	0.96	0.17	0.16	0.16	0.17
Copper	81	33.7	32.1	18.9	10.2
Lead	66	14.8	31.9	6.37	4.80
Mercury	0.21	0.07 J	0.12 J	0.05 UJ	0.05 UJ
Nickel	140	22.1	17.4	17.7	12.9
Silver	1.2	0.19	0.21	0.04	0.03
Zinc	160	77.4	74.4	60.5	63.7
Butyltins in µg/kg					
Tributyltin	73	24	35	15	190
Dibutyltin		1	2	1 U	5
Tetra-n-butyltin		1	1 U	1 U	2
Pesticide/PCBs in µg/kg					
Alpha-BHC		2 U	2 U	2 U	2 U
Beta-BHC		2 U	2 U	2 U	2 U
Gamma-BHC(Lindane)	10	2 U	2 U	2 U	2 U
Delta-BHC		2 U	2 U	2 U	2 U
Heptachlor	10	2 U	2 U	2 U	2 U
Aldrin	10	2 U	2 U	2 U	2 U
Heptachlor Epoxide		2 U	2 U	2 U	2 U
Endosulfan I		2 U	2 U	2 U	2 U
Dieldrin	10	2 U	2 U	2 U	2 U
4,4'-DDE		2 U	2	2 U	2 U
Endrin		2 U	2 U	2 U	2 U
Endosulfan II		2 U	2 U	2 U	2 U
4,4'-DDD		2 U	2 U	2 U	2 U
Endrin Aldehyde		2 U	2 U	2 U	2 U
Endosulfan Sulfate		2 U	2 U	2 U	2 U
4,4'-DDT		2 U	2 U	2 U	2 U
Total DDT	6.9	2 U	2	2 U	2 U
Methoxychlor		4 U	4 U	4 U	4 U

Table 2 - Analytical Results for Sediment Samples

	PSDDA Scr. Level	Terminal 2 HC-T2-02 Dup	Terminal 2 HC-T2-03	Terminal 5 HC-T5-01	Terminal 5 HC-T5-02
Toxaphene		30 U	30 U	30 U	30 U
Chlordane	10	10 U	10 U	10 U	10 U
Aroclor 1016		10 U	10 U	10 U	10 U
Aroclor 1221		10 U	10 U	10 U	10 U
Aroclor 1232		10 U	10 U	10 U	10 U
Aroclor 1242		10 U	10 U	10 U	10 U
Aroclor 1248		10 U	10 U	10 U	10 U
Aroclor 1254		10 U	71	10 U	10 U
Aroclor 1260		10 U	28	10 U	10 U
Total PCBs	130	10 U	99	10 U	10 U
PAHs in µg/kg					
Total LPAHs	610	28	338	13	10 U
Naphthalene	210	10 U	46	10 U	10 U
Acenaphthylene	64	10 U	11	10 U	10 U
Acenaphthene	63	10 U	56	10 U	10 U
Fluorene	64	10 U	27	10 U	10 U
Phenanthrene	320	28	166	13	10 U
Anthracene	130	10 U	32	10 U	10 U
2-Methylnaphthalene	67	10 U	19	10 U	10 U
Total HPAHs	1800	227	736	410	10 U
Fluoranthene	630	41	152	52	10 U
Pyrene	430	43 J	184 J	60 J	10 UJ
Benzo(a)anthracene	450	21	61	69	10 U
Chrysene	670	28	69	79	10 U
Total Benzofluoranthenes	800	37	87	79	10 U
Benzo(a)pyrene	680	22	70	36	10 U
Indeno(1,2,3-c,d)pyrene	69	17	54	20	10 U
Dibenz(a,h)anthracene	120	10 U	10 U	10 U	10 U
Benzo(g,h,i)perylene	540	18	59	15	10 U
Phenols in µg/kg					
Phenol	120	50 U	50 U	50 U	50 U
2-Methylphenol	20	50 U	50 U	50 U	50 U
3/4-Methylphenol	120	50 U	50 U	50 U	50 U
2,4-Dimethylphenol	29	50 U	50 U	50 U	50 U
Pentachlorophenol	100	50 U	50 U	50 U	50 U

J - Estimated Concentration

U - Not detected at indicated detection limit.

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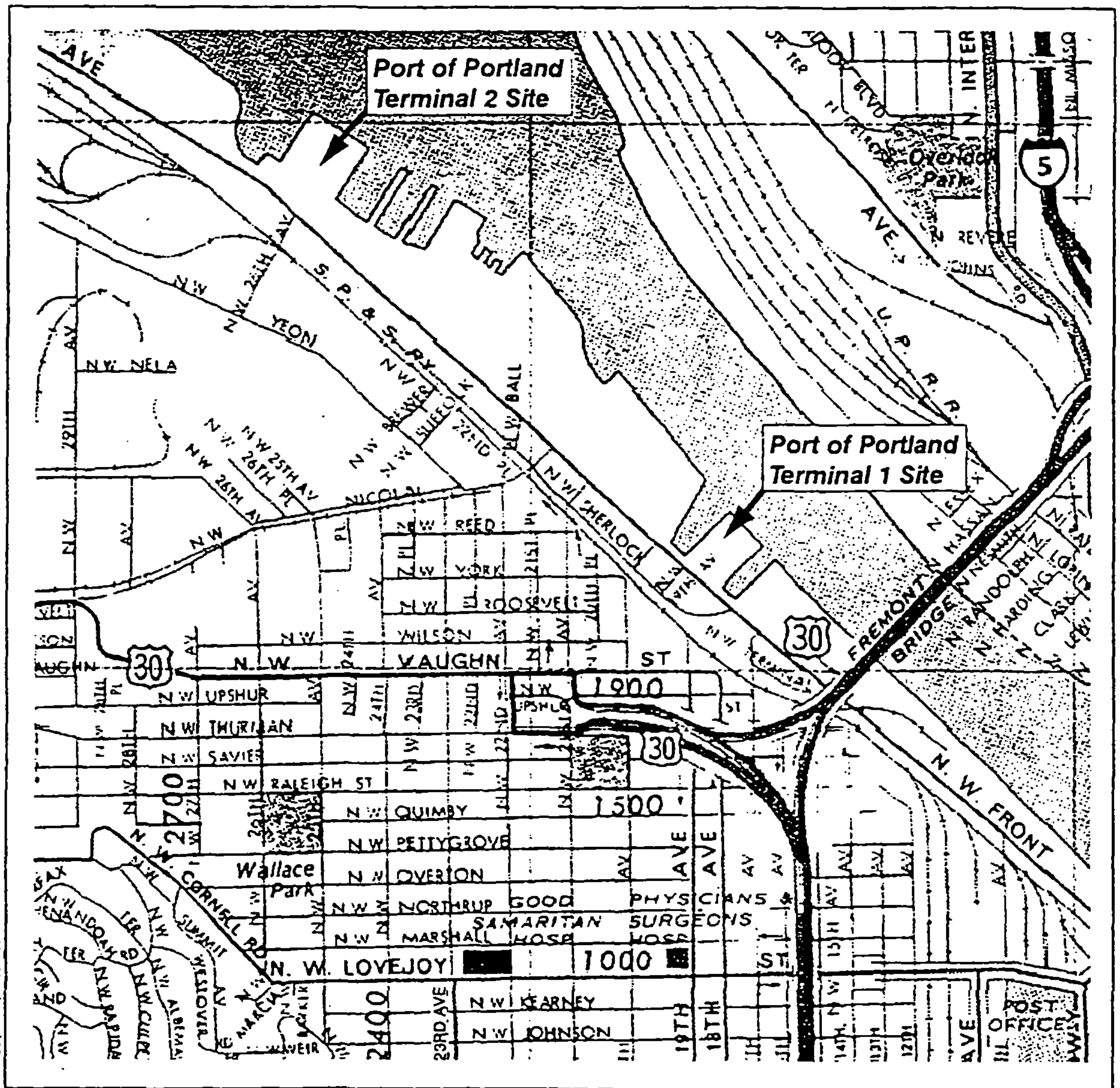
Vicinity Map



COREL\5589VMAP A

0 1/4 1/2

Scale in Miles

N

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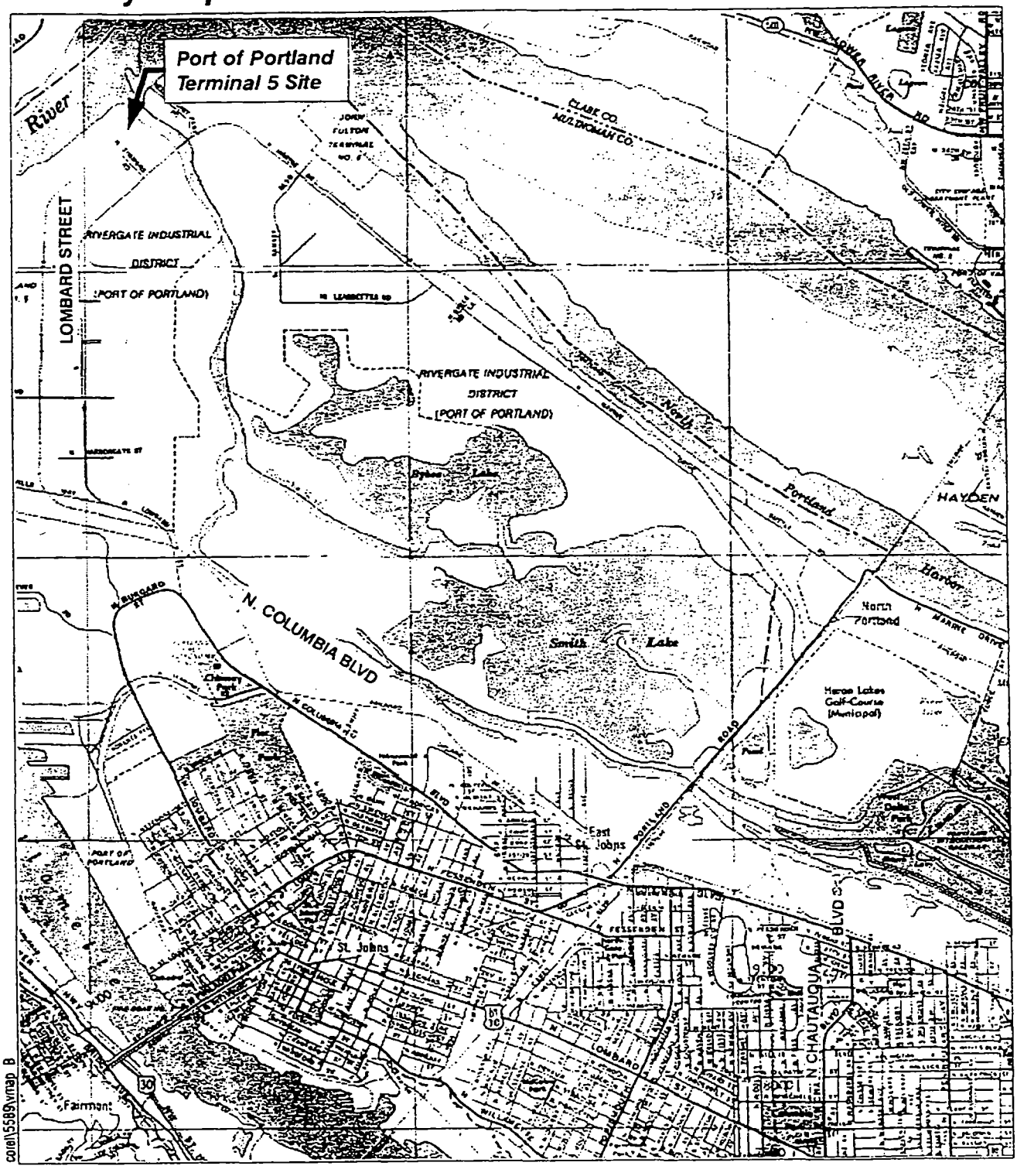
Figure 1

Vicinity Map



0 1/2 1

Scale in Miles

N

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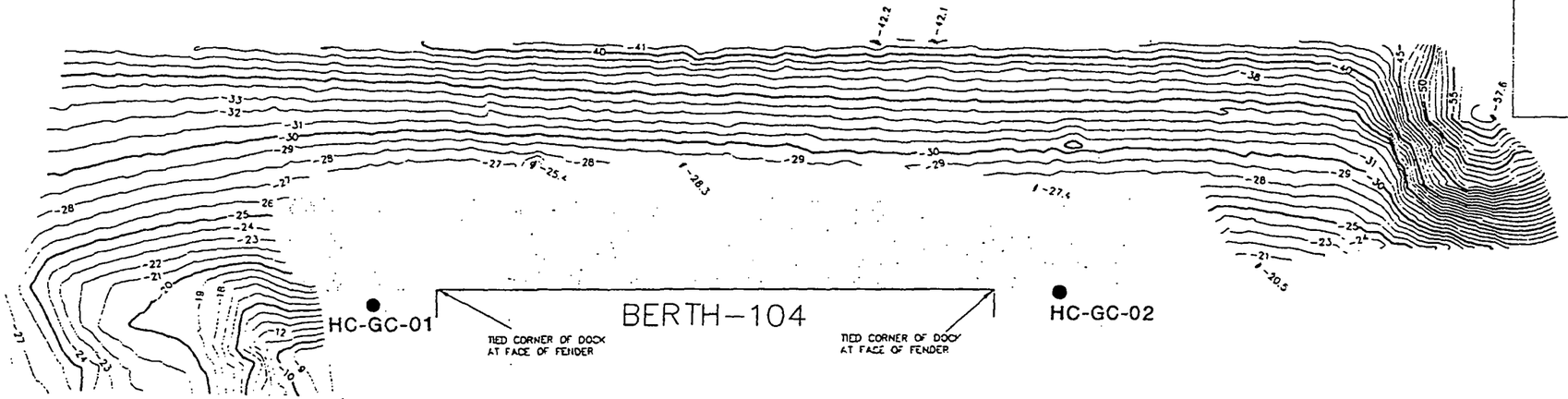
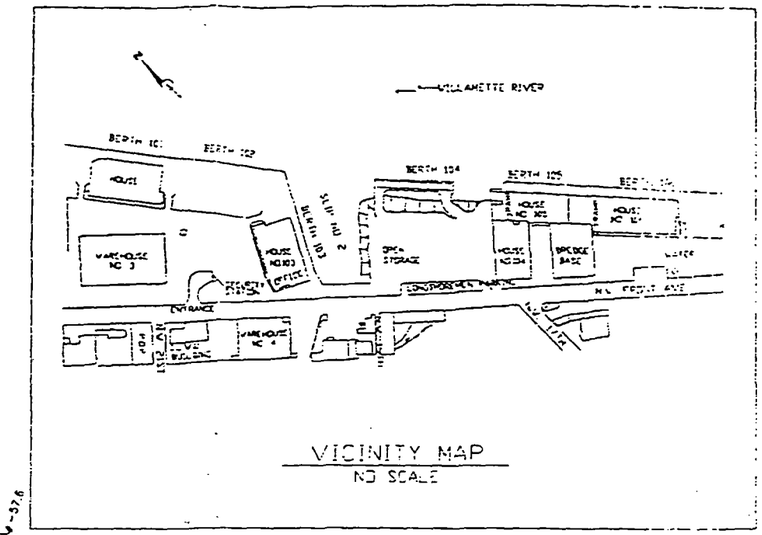
Figure 2

Sampling Location Plan - Terminal 1

Port of Portland





VOLUME CALCULATIONS

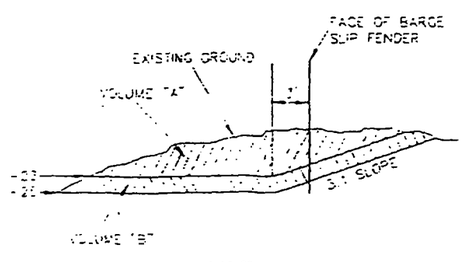
VOLUME "A"=4219 CUBIC YARDS

VOLUME "B"=3768 CUBIC YARDS

VOLUME "A" + VOLUME "B"=7987 CUBIC YARDS

0 100 200

Scale in Feet



NOT TO SCALE

Proposed Dredging Prism (Approximate*)

●HC-GC-01 Sampling Location and Number

*Note: Hydrographic survey incomplete because grounded vessel prohibited berth access.

1. HORIZONTAL DATUM: ASSUMED

2. CONTOURS ARE SHOWN IN FEET AND INDICATE DEPTHS BELOW COLUMBIA RIVER DATUM ZERO. THE TIDE BOARD USED IS LOCATED AT BERTH–103.

3. HORIZONTAL POSITIONS FOR NAVIGATION AND DATA COLLECTION WERE DETERMINED BY USING A HYDRO–II RANGE–AZIMITH SYSTEM.

4. BATHYMETRIC DATA WERE COLLECTED USING AN INNERSPACE–446 ECHOSOUNDER WITH AN 8° SINGLE BEAM TRANSDUCER.

5. SURVEY DATA WERE COLLECTED LONGITUDINALLY WITH THE DOCK FACE USING A TWENTY–FIVE FOOT LINE SPACING. THE SURVEY DATA COLLECTED ALONG EACH SURVEY LINE WERE THINNED USING A "SHOAL BIAS" METHOD TO AN APPROXIMATE HORIZONTAL SPACING OF 5 FEET.

6. THERE MAY BE BOTTOM FEATURES THAT ARE NOT SHOWN ON THIS MAP BECAUSE OF THE LINE SPACING INTERVAL. THIS SURVEY DOES NOT INCLUDE BATHYMETRIC DATA BETWEEN THE ADJACENT SURVEY LINES.

7. THIS BATHYMETRIC SURVEY IS REPRESENTATIVE OF THE CONDITION OF THE RIVER BOTTOM AT THE TIME OF THE SURVEY BASED ON THE LINE SPACING INTERVAL AND THINNING METHOD USED. THE CONDITION OF THE RIVER BOTTOM MAY CHANGE AT ANY TIME AFTER THE DATE OF THIS SURVEY.

8. HYDROGRAPHIC SURVEY DATA COLLECTED: OCTOBER 2, 1996

9. THIS SURVEY IS FOR A VOLUME ESTIMATE ONLY. THE VOLUME IS NOT ACCURATE AS THERE WAS A SHIP IN THE BERTH AT THE TIME OF THE SURVEY, AND NO DATA COULD BE COLLECTED UNDER THE SHIP. THE VOLUME WAS CALCULATED BY EXTRAPOLATING THE DATA COLLECTED AROUND THE SHIP. THE CONTOURS SHOWN ARE ACCURATE AS THEY WERE GENERATED FROM THE ONLY DATA THAT COULD BE COLLECTED.

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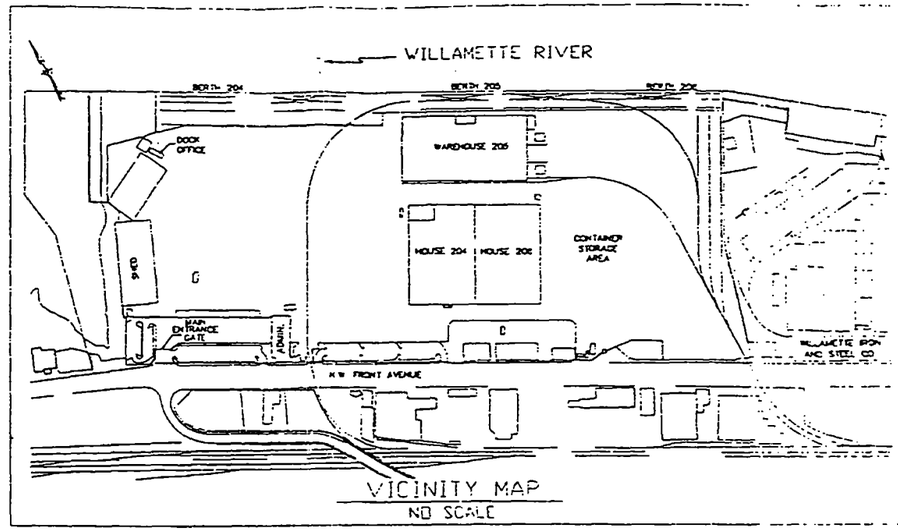
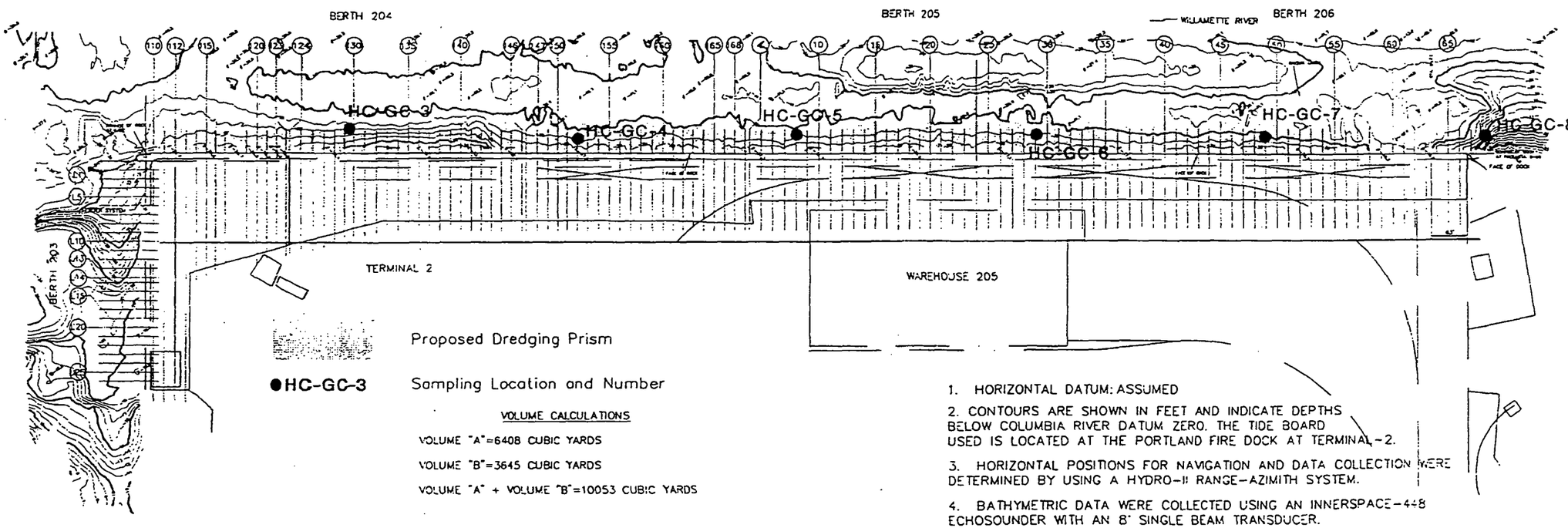
Figure 3

Sampling Location Plan - Terminal 2

Port of Portland





Proposed Dredging Prism

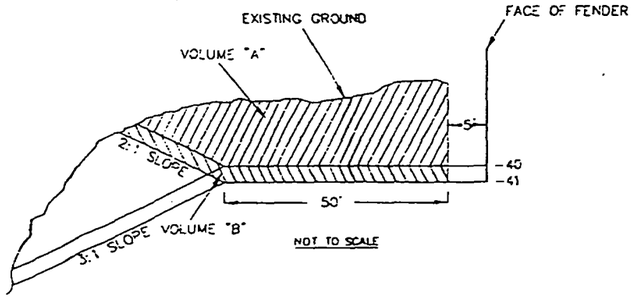
●HC-GC-3 Sampling Location and Number

VOLUME CALCULATIONS

VOLUME "A"=6408 CUBIC YARDS

VOLUME "B"=3645 CUBIC YARDS

VOLUME "A" + VOLUME "B"=10053 CUBIC YARDS



1. HORIZONTAL DATUM: ASSUMED
2. CONTOURS ARE SHOWN IN FEET AND INDICATE DEPTHS BELOW COLUMBIA RIVER DATUM ZERO. THE TIDE BOARD USED IS LOCATED AT THE PORTLAND FIRE DOCK AT TERMINAL-2.
3. HORIZONTAL POSITIONS FOR NAVIGATION AND DATA COLLECTION WERE DETERMINED BY USING A HYDRO-II RANGE-AZIMITH SYSTEM.
4. BATHYMETRIC DATA WERE COLLECTED USING AN INNERSPACE-448 ECHOSOUNDER WITH AN 8° SINGLE BEAM TRANSDUCER.
5. SURVEY DATA WERE COLLECTED LONGITUDINALLY WITH THE DOCK FACE USING A TWENTY-FIVE FOOT LINE SPACING. THE SURVEY DATA COLLECTED ALONG EACH SURVEY LINE WERE THINNED USING A "SHOAL BIAS" METHOD TO AN APPROXIMATE HORIZONTAL SPACING OF 5 FEET.
6. THERE MAY BE BOTTOM FEATURES THAT ARE NOT SHOWN ON THIS MAP BECAUSE OF THE LINE SPACING INTERVAL. THIS SURVEY DOES NOT INCLUDE BATHYMETRIC DATA BETWEEN THE ADJACENT SURVEY LINES
7. THIS BATHYMETRIC SURVEY IS REPRESENTATIVE OF THE CONDITION OF THE RIVER BOTTOM AT THE TIME OF THE SURVEY BASED ON THE LINE SPACING INTERVAL AND THINNING METHOD USED. THE CONDITION OF THE RIVER BOTTOM MAY CHANGE AT ANY TIME AFTER THE DATE OF THIS SURVEY.
8. HYDROGRAPHIC SURVEY DATA COLLECTED: SEPTEMBER 5, 1996

N

0 200 400

Scale in Feet

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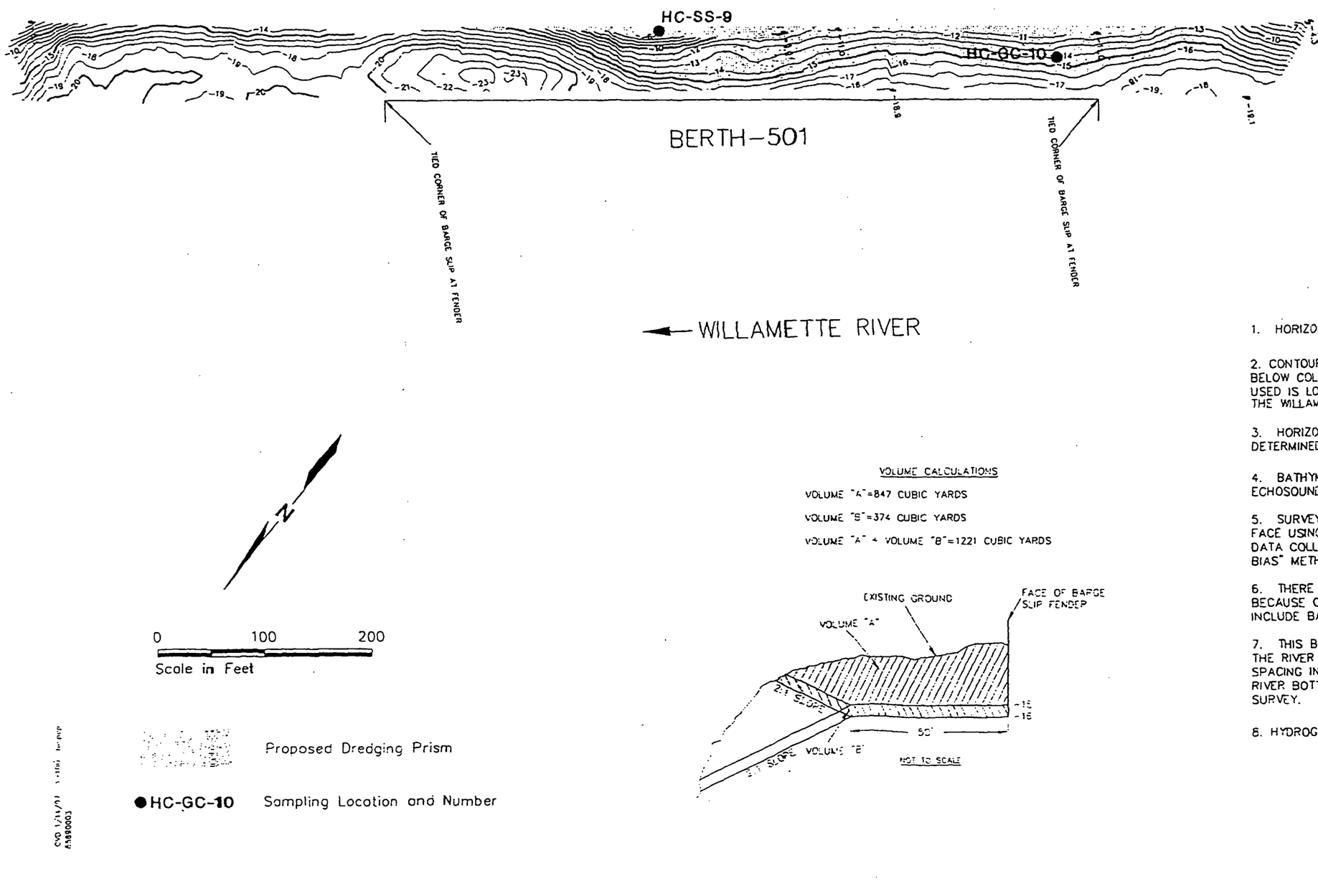
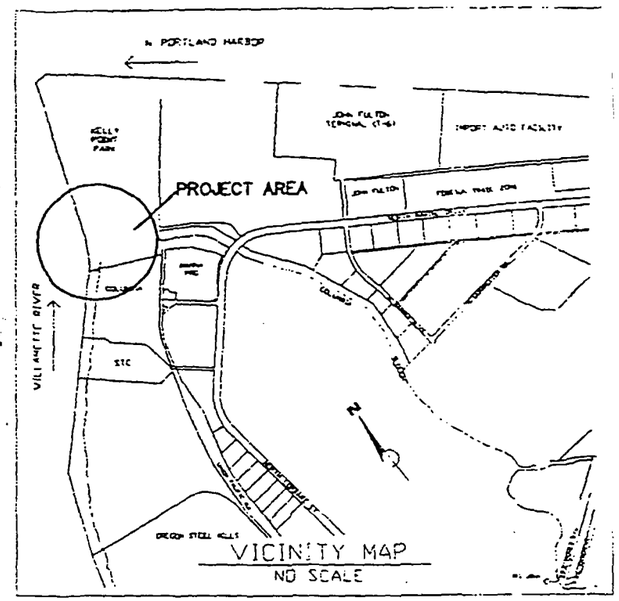
Figure 4

Sampling Location Plan - Terminal 5

Port of Portland





Proposed Dredging Prism

●HC-GC-10 Sampling Location and Number

VOLUME CALCULATIONS

VOLUME "A"=847 CUBIC YARDS

VOLUME "B"=374 CUBIC YARDS

VOLUME "A" + VOLUME "B"=1221 CUBIC YARDS

1. HORIZONTAL DATUM: ASSUMED

2. CONTOURS ARE SHOWN IN FEET AND INDICATE DEPTHS BELOW COLUMBIA RIVER DATUM ZERO. THE TIDE BOARD USED IS LOCATED KELLY POINT AT THE CONFLUENCE OF THE WILLAMETTE RIVER.

3. HORIZONTAL POSITIONS FOR NAVIGATION AND DATA COLLECTION WERE DETERMINED BY USING A HYDRO-II RANGE-AZIMITH SYSTEM.

4. BATHYMETRIC DATA WERE COLLECTED USING AN INNERSPACE-448 ECHOSOUNDER WITH AN 8° SINGLE BEAM TRANSDUCER.

5. SURVEY DATA WERE COLLECTED LONGITUDINALLY WITH THE DOCK FACE USING A TWENTY-FIVE FOOT LINE SPACING. THE SURVEY DATA COLLECTED ALONG EACH SURVEY LINE WERE THINNED USING A "SHOAL BIAS" METHOD TO AN APPROXIMATE HORIZONTAL SPACING OF 5 FEET.

6. THERE MAY BE BOTTOM FEATURES THAT ARE NOT SHOWN ON THIS MAP BECAUSE OF THE LINE SPACING INTERVAL. THIS SURVEY DOES NOT INCLUDE BATHYMETRIC DATA BETWEEN THE ADJACENT SURVEY LINES.

7. THIS BATHYMETRIC SURVEY IS REPRESENTATIVE OF THE CONDITION OF THE RIVER BOTTOM AT THE TIME OF THE SURVEY BASED ON THE LINE SPACING INTERVAL AND THINNING METHOD USED. THE CONDITION OF THE RIVER BOTTOM MAY CHANGE AT ANY TIME AFTER THE DATE OF THIS SURVEY.

8. HYDROGRAPHIC SURVEY DATA COLLECTED: SEPTEMBER 16, 1996

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Figure 5

APPENDIX A
CHEMICAL DATA QUALITY REVIEW AND CERTIFICATES OF ANALYSIS COLUMBIA ANALYTICAL LABORATORIES

APPENDIX A
CHEMICAL DATA QUALITY REVIEW AND CERTIFICATES OF ANALYSIS COLUMBIA ANALYTICAL LABORATORIES

Sediment Chemical Data Quality Review

Eight sediment samples, including one field duplicate, were collected on November 13 and 14, 1996. The samples were submitted to Columbia Analytical Services of Portland, OR for analyses of the following:

- Polycyclic aromatic hydrocarbons and phenols - EPA Method 8270 SIM
- Pesticides/PCBs - EPA Method 8080A
- Tributyltin - Krone et al. (1988)
- Total metals - EPA Method 6000/7000
- Ammonia - EPA 350.1M
- Sulfide - PSEP (1995)
- Total organic carbon - ASTM D4129-82M

The following criteria were evaluated as part of this data quality review:

- Holding times;
- Method blanks;
- Surrogate recoveries;
- Laboratory duplicates relative percent differences (RPDs);
- Matrix spike/matrix spike duplicate (MS/MSD) recoveries and RPDs; and
- Field duplicate relative percent differences.

Semivolatile Organics. The sediment samples were analyzed within the required holding times. No method blank contamination was present. Surrogate recoveries were within control limits established by the laboratory. MS/MSD recoveries were acceptable. No laboratory control limit was established for the MS/MSD RPD, so a control limit of 35 percent was used to evaluate the data. RPDs for all analytes were within this control limit, with the exception of pyrene. The RPD for this compound was 51 percent, so sample results for pyrene were qualified as estimated ("J/UJ"). One field duplicate, HC-T2-02-Dup, was submitted for analysis. The RPD for the field duplicate pair HC-T2-02/HC-T2-02-Dup was calculated for results five

times greater than the reporting limit. The RPD ranged from 19 to 57 percent. The results, as qualified, are acceptable.

Pesticides/PCBs. The samples were analyzed within the required holding times. No method blank contamination was present. Surrogate and LCS recoveries were within control limits established by the laboratory, with the following exception. The surrogate recovery of TCMX in the method blank was below control limits. However, recovery of DCB was within control limits for the method blank, so no qualifiers were assigned. MS/MSD recoveries were acceptable. No laboratory control limit was established for the MS/MSD RPD, so a control limit of 35 percent was used to evaluate the data. MS/MSD RPDs were acceptable. One field duplicate, HC-T2-02-Dup, was submitted for analysis. The RPD for the field duplicate pair HC-T2-02/ HC-T2-02-Dup could not be calculated since sample results were not detected. The results as reported are acceptable.

Tributyltin. The samples were analyzed within the required holding times. No method blank contamination was present. Surrogate recoveries were acceptable. MS/MSD recoveries and RPDs for tributyltin were not calculated since the sample concentration was greater than the spike concentration. However, recovery of the LCS was acceptable, so no data were qualified. No laboratory control limit was established for RPDs, so a control limit of 35 percent was used to evaluate the data. One field duplicate, HC-T2-02-Dup, was submitted for analysis. The RPD for the field duplicate pair HC-T2-02/HC-T2-02-Dup was 18 percent. The results as reported are acceptable.

Total Metals. The samples were analyzed within the required holding times. No method blank contamination was present. No laboratory control limit was established for RPDs, so a control limit of 35 percent was used to evaluate the data. Laboratory duplicate RPDs were within this control limit with the following exception. The RPD for mercury was 61 percent, so sample results for mercury were qualified as estimated ("J/UJ"). Matrix spike recoveries were within control limits. One field duplicate, HC-T2-02-Dup, was submitted for analysis. The RPD for the field duplicate pair HC-T2-02/HC-T2-02-Dup was calculated for results five times greater than the reporting limit. The RPDs ranged from 2 to 9 percent. The data, as qualified, are acceptable.

Ammonia, Sulfide, and Total Organic Carbon. The samples were analyzed within the required holding times. QC results for the LCS and the matrix spike associated with the first analysis of sulfide were outside of control limits so the samples were reanalyzed. The QC associated with the

reanalysis was acceptable, so results from the second analysis were reported. No method blank contamination was present. No laboratory control limit was established for RPDs, so a control limit of 35 percent was used to evaluate the data. Laboratory duplicate RPDs were within this control limit, with the exception of sulfide. The duplicate RPD for this compound was 61 percent, so all sample results were qualified as estimated ("J/UJ"). Matrix spike recoveries were acceptable. One field duplicate, HC-T2-02-Dup, was submitted for analysis. The RPDs for the field duplicate pair HC-T2-02/HC-T2-02-Dup were; 0 percent for ammonia, 4.7 percent for total organic carbon, and 91 percent for sulfide. The data are acceptable as reported.

Finalapp.doc

Hart Crowser
J-5589

CERTIFICATES OF ANALYSIS
COLUMBIA ANALYTICAL SERVICES, INC.

Columbia Analytical Services inc.

December 11, 1996 Service Request No: K9607334

Taku Fuji
Hart Crowser, Inc.
1910 Fairview Avenue East
Seattle, WA 98102-3699

Re: Port of Portland/Project #5589

Dear Taku:

Enclosed are the results of the sample(s) submitted to our laboratory on November 13 and 14, 1996. Preliminary results were transmitted via facsimile on December 2, 3, 4, 5, and 10, 1996. For your reference, these analyses have been assigned our service request number K9607334.

All analyses were performed consistent with our laboratory's quality assurance program. All results are intended to be considered in their entirety, and Columbia Analytical Services, Inc. (CAS) is not responsible for use of less than the complete report. Results apply only to the samples analyzed.

Please call if you have any questions. My extension is 246.

Respectfully submitted,

Columbia Analytical Services, Inc.

Abbie Spielman
Client Services Manager

AS/ll

cc: Dana Siegfried, Port of Portland, Portland, OR

COLUMBIA ANALYTICAL SERVICES, Inc.

Acronyms

ASTM	American Society for Testing and Materials
A2LA	American Association for Laboratory Accreditation
CARB	California Air Resources Board
CAS Number	Chemical Abstract Service registry Number
CFC	Chlorofluorocarbon
CFU	Colony-Forming Unit
DEC	Department of Environmental Conservation
DEQ	Department of Environmental Quality
DHS	Department of Health Services
DOE	Department of Ecology
DOH	Department of Health
EPA	U. S. Environmental Protection Agency
ELAP	Environmental Laboratory Accreditation Program
GC	Gas Chromatography
GC/MS	Gas Chromatography/Mass Spectrometry
J	Estimated concentration. The value is less than the method reporting limit, but greater than the method detection limit.
LUFT	Leaking Underground Fuel Tank
M	Modified
MCL	Maximum Contaminant Level is the highest permissible concentration of a substance allowed in drinking water as established by the USEPA.
MDL	Method Detection Limit
MPN	Most Probable Number
MRL	Method Reporting Limit
NA	Not Applicable
NAN	Not Analyzed
NC	Not Calculated
NCASI	National Council of the Paper Industry for Air and Stream Improvement
ND	Not Detected at or above the MRL
NIOSH	National Institute for Occupational Safety and Health
PQL	Practical Quantitation Limit
RCRA	Resource Conservation and Recovery Act
SIM	Selected Ion Monitoring
TPH	Total Petroleum Hydrocarbons
tr	Trace level is the concentration of an analyte that is less than the PQL but greater than or equal to the MDL.

COLUMBIA ANALYTICAL SERVICES, INC.

Client:	Hart Crowser, Inc.	**Service Request No.:**	K9607334
Project:	Port of Portland/5589	**Date Received:**	11/13-14/96
Sample Matrix:	Sediment		

CASE NARRATIVE

All analyses were performed consistent with the quality assurance program of Columbia Analytical Services, Inc. (CAS). This report contains analytical results for sample(s) designated for Tier II data deliverables. When appropriate to the method, method blank results have been reported with each analytical test. Surrogate recoveries have been reported for all applicable organic analyses. Additional quality control analyses reported herein include: Laboratory Duplicate (DUP), Matrix Spike (MS), and Matrix/Duplicate Matrix Spike (MS/DMS).

All EPA recommended holding times have been met for analyses in this sample delivery group.

The following difficulties were experienced during analysis of this batch:

All samples were initially analyzed for Total Sulfide (PSEP) on 11/20/96 within the recommended holding time. The LCS and Matrix Spike recoveries were outside normal CAS control limits. All samples were reanalyzed both on 12/3/96 and on 12/6/96 past the recommended holding time. The QA/QC results for the 12/6 reanalysis are within CAS acceptance criteria. The sample results from the 12/6 reanalysis are comparable to the initial analysis, indicating that the quality of the sample data was not significantly affected by the exceedance of holding time. The values from the 12/6 reanalysis are reported in the sample results section of this report.

As requested, all sediment samples were analyzed for butyltin compounds. Results for the di-butyl, tributyl and tetra-butyl tin compounds are reported in the results section of this report. Mono-butyl tin was not detected in any of the sediment samples, however the results for this compound should be considered as estimated. Recoveries of mono-butyl tin is extremely poor by this method in comparison to other butyl tin compounds. Spike recoveries for the associated LCS and MS/DMS of mono-butyl tin in this batch were 5% or less. All QA/QC associated with the other compounds in the analysis met CAS acceptance criteria.

One surrogate recovery for EPA 8080 in the Method Blank (MB) was outside normal CAS control limits. All other QA/QC associated with the analysis of these samples was within normal CAS control limits, so no further corrective action was taken.

The Matrix Spike/Duplicate Matrix Spike (MS/DMS) recoveries of Tributyltin for sample HC-T2-03 was not calculated. The analyte concentration in the sample was significantly higher than the added spike concentration, preventing accurate evaluation of the spike recovery.

Approved by ami Kpiln **Date** 12/11/96

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: Hart Crowser, Inc.
Project: Port of Portland/5589
Sample Matrix: Sediment

Service Request: K9607334
Date Collected: 11/13-11/14/96
Date Received: 11/13-11/14/96
Date Extracted: NA
Date Analyzed: 11/19/96

Solids, Total
EPA Method 160.3 Modified
Units: Percent (%)

Sample Name	Lab Code	Result
C-T5-01	K9607334-002	67.7
C-T2-02	K9607334-003	49.3
HC-T2-02 Dup	K9607334-004	49.4
C-T2-03	K9607334-005	55.6
C-T2-01 11/13, 11/14 comp	K9607334-007	49.2
HC-T1-01	K9607334-008	49.1
C-T1-02	K9607334-009	47.6
C-T5-02	K9607334-010	72.9

Approved By: JC Date: 11/25/96

/102094
07334ICP_AM1 - TSolids 11/21/96

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

lient:	Hart Crowser, Inc.	**Service Request:**	K9607334
roject:	Port of Portland/5589	**Date Collected:**	11/13/96
ample Matrix:	Sediment	**Date Received:**	11/13/96
		Date Extracted:	NA

Inorganic Parameters
Units: mg/Kg (ppm)
Dry Weight Basis

Analyte:	Ammonia as Nitrogen*	Sulfide, Total	Total Organic Carbon (%)
EPA Method:	350.1M	PSEP	ASTM D4129-82M
Method Reporting Limit:	0.5	0.5	0.05
Date Analyzed:	11/25/96	11/20-12/6/96	11/27/96

ample Name	Lab Code			
C-T5-01	K9607334-002	35	ND u J	0.53
C-T2-02	K9607334-003	200	1.2 J	2.20
C-T2-02 Dup	K9607334-004	200	3.2 J	2.10
C-T2-03	K9607334-005	190	11 J	1.92
C-T2-01	K9607334-007	180	0.9 J	2.18
C-T1-01	K9607334-008	270	1.1 J	2.61
C-T1-02	K9607334-009	360	2.6 J	2.52
C-T5-02	K9607334-010	4.8	ND u J	0.52
lethod Blank	K9607334-MB	ND	ND u J	ND

12-17-96
KCA

Analysis was performed on a 2M KCl extract.
1 Modified

pproved By: _____ Date: 12/10/96

DW/061694
07334WET.LJ1 - 3_Tests 12/10/96

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: Hart Crowser, Inc.
Project: Port of Portland/5589
Sample Matrix: Sediment

Service Request: K9607334
Date Collected: 11/13-11/14/96
Date Received: 11/13-11/14/96
Date Extracted: NA
Date Analyzed: 11/19/96

Solids, Volatile
EPA Method 160.4 Modified
Units: Percent (%)
Dry Weight Basis

Sample Name	Lab Code	Result
HC-T5-01	K9607334-002	4.30
HC-T2-02	K9607334-003	6.68
HC-T2-02 Dup	K9607334-004	6.19
HC-T2-03	K9607334-005	5.76
HC-T2-01 11/13, 11/14 comp	K9607334-007	6.62
HC-T1-01	K9607334-008	7.28
HC-T1-02	K9607334-009	7.37
HC-T5-02	K9607334-010	2.00

Approved By: _____ Date: 11/25/96

V102094
07334ICP.AM1 - TVS 11/21/96

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	Hart Crowser, Inc.	**Service Request:**	K9607334
Project:	Port of Portland/5589	**Date Collected:**	11/13/96
Sample Matrix	Sediment	**Date Received:**	11/13/96
		Date Analyzed:	11/27/96

Particle Size Determination
Puget Sound Estuary Program Protocol

Sample Name: HC-T5-01
Lab Code: K9607334-002

Sand Fraction:	Dry Weight (Grams)	50.8961
Sand Fraction:	Weight Recovered (Grams)	51.2382
Sand Fraction:	Percent Recovery	101

Description	Phi Size	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel	<-1 Ø	0.2545	0.44
Very Coarse Sand	-1 to 0 Ø	0.4304	0.75
Coarse Sand	0 to 1 Ø	1.9619	3.40
Medium Sand	1 to 2 Ø	18.1810	31.5
Fine Sand	2 to 3 Ø	19.3198	33.5
Very Fine Sand	3 to 4 Ø	9.8276	17.1
Silt	4 to 8 Ø	7.4900	13.0
Clay	> 8 Ø	2.0150	3.50
	Total	59.4802	103

Approved By: _____ Date: 11/27/96

00007

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	Hart Crowser, Inc.	**Service Request:**	K9607334
Project:	Port of Portland/5589	**Date Collected:**	11/13/96
Sample Matrix	Sediment	**Date Received:**	11/13/96
		Date Analyzed:	11/27/96

Particle Size Determination
Puget Sound Estuary Program Protocol

Sample Name: HC-T2-02
Lab Code: K9607334-003

Sand Fraction:	Dry Weight (Grams)	12.5810
Sand Fraction:	Weight Recovered (Grams)	12.8260
Sand Fraction:	Percent Recovery	102

Description	Phi Size	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel	<-1 Ø	0.0064	0.02
Very Coarse Sand	-1 to 0 Ø	0.0643	0.20
Coarse Sand	0 to 1 Ø	0.1338	0.41
Medium Sand	1 to 2 Ø	0.6709	2.08
Fine Sand	2 to 3 Ø	5.2249	16.2
Very Fine Sand	3 to 4 Ø	5.0233	15.5
Silt	4 to 8 Ø	19.8250	61.4
Clay	> 8 Ø	2.4650	7.63
	Total	33.4136	103

Approved By: _____ Date: 11/27/96

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	Hart Crowser, Inc.	**Service Request:**	K9607334
Project:	Port of Portland/5589	**Date Collected:**	11/13/96
Sample Matrix	Sediment	**Date Received:**	11/13/96
		Date Analyzed:	11/27/96

Particle Size Determination
Puget Sound Estuary Program Protocol

Sample Name: HC-T2-02 Dup
Lab Code: K9607334-004

Sand Fraction: Dry Weight (Grams)	11.9132
Sand Fraction: Weight Recovered (Grams)	12.0900
Sand Fraction: Percent Recovery	101

Description	Phi Size	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel	<-1 Ø	0.0067	0.02
Very Coarse Sand	-1 to 0 Ø	0.0691	0.21
Coarse Sand	0 to 1 Ø	0.1364	0.42
Medium Sand	1 to 2 Ø	0.8009	2.47
Fine Sand	2 to 3 Ø	5.3241	16.5
Very Fine Sand	3 to 4 Ø	4.4669	13.8
Silt	4 to 8 Ø	19.6050	60.6
Clay	> 8 Ø	2.4300	7.51
	Total	32.8391	101

Approved By: _____ Date: 11/27/96

COLUMBIA ANALYTICAL SERVICES, INC.

•Analytical Report

Client:	Hart Crowser, Inc.	**Service Request:**	K9607334
Project:	Port of Portland/5589	**Date Collected:**	11/13/96
Sample Matrix	Sediment	**Date Received:**	11/13/96
		Date Analyzed:	11/27/96

Particle Size Determination
Puget Sound Estuary Program Protocol

Sample Name: HC-T2-03
Lab Code: K9607334-005

Sand Fraction:	Dry Weight (Grams)	15.1883
Sand Fraction:	Weight Recovered (Grams)	15.3429
Sand Fraction:	Percent Recovery	101

Description	Phi Size	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel	<-1 Ø	0.1955	0.59
Very Coarse Sand	-1 to 0 Ø	0.0694	0.21
Coarse Sand	0 to 1 Ø	0.6594	1.98
Medium Sand	1 to 2 Ø	4.6214	13.8
Fine Sand	2 to 3 Ø	4.0341	12.1
Very Fine Sand	3 to 4 Ø	4.6052	13.8
Silt	4 to 8 Ø	15.3850	46.1
Clay	> 8 Ø	2.8600	8.57
	Total	32.4300	97.2

Approved By: _____ Date: 11/27/96

00010

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	Hart Crowser, Inc.	**Service Request:**	K9607334
Project:	Port of Portland/5589	**Date Collected:**	11/13/96
Sample Matrix	Sediment	**Date Received:**	11/13/96
		Date Analyzed:	11/27/96

Particle Size Determination
Puget Sound Estuary Program Protocol

Sample Name: HC-T2-03
Lab Code: K9607334-005d

Sand Fraction:	Dry Weight (Grams)	15.3162
Sand Fraction:	Weight Recovered (Grams)	15.4686
Sand Fraction:	Percent Recovery	101

Description	Phi Size	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel	<-1 Ø	0.3125	0.93
Very Coarse Sand	-1 to 0 Ø	0.0763	0.23
Coarse Sand	0 to 1 Ø	0.6771	2.03
Medium Sand	1 to 2 Ø	4.7272	14.1
Fine Sand	2 to 3 Ø	4.1191	12.3
Very Fine Sand	3 to 4 Ø	4.3923	13.1
Silt	4 to 8 Ø	15.0950	45.1
Clay	> 8 Ø	2.6850	8.03
	Total	32.0845	96.0

Approved By: _____ Date: 11/27/96

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	Hart Crowser, Inc.	**Service Request:**	K9607334
Project:	Port of Portland/5589	**Date Collected:**	11/13/96
Sample Matrix	Sediment	**Date Received:**	11/13/96
		Date Analyzed:	11/27/96

Particle Size Determination
Puget Sound Estuary Program Protocol

Sample Name: HC-T2-03
Lab Code: K9607334-005t

Sand Fraction:	Dry Weight (Grams)	15.4740
Sand Fraction:	Weight Recovered (Grams)	15.6184
Sand Fraction:	Percent Recovery	101

Description	Phi Size	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel	<-1 Ø	0.0230	0.07
Very Coarse Sand	-1 to 0 Ø	0.0932	0.28
Coarse Sand	0 to 1 Ø	0.6896	2.06
Medium Sand	1 to 2 Ø	4.6606	13.9
Fine Sand	2 to 3 Ø	4.1199	12.3
Very Fine Sand	3 to 4 Ø	4.6902	14.0
Silt	4 to 8 Ø	15.2750	45.6
Clay	> 8 Ø	2.8500	8.50
	Total	32.4015	96.7

Approved By: _____ Date: 11/22/96

00012

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	Hart Crowser, Inc.	**Service Request:**	K9607334
Project:	Port of Portland/5589	**Date Collected:**	11/14/96
Sample Matrix	Sediment	**Date Received:**	11/14/96
		Date Analyzed:	11/27/96

Particle Size Determination
Puget Sound Estuary Program Protocol

Sample Name: HC-T2-01
Lab Code: K9607334-007

Sand Fraction: Dry Weight (Grams)	8.0366
Sand Fraction: Weight Recovered (Grams)	8.1446
Sand Fraction: Percent Recovery	101

Description	Phi Size	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel	<-1 Ø	0.2365	0.95
Very Coarse Sand	-1 to 0 Ø	0.0388	0.16
Coarse Sand	0 to 1 Ø	0.1460	0.59
Medium Sand	1 to 2 Ø	0.3794	1.52
Fine Sand	2 to 3 Ø	2.9510	11.8
Very Fine Sand	3 to 4 Ø	3.2952	13.2
Silt	4 to 8 Ø	16.6150	66.7
Clay	> 8 Ø	2.0500	8.22
	Total	25.7119	103

Approved By: _____ Date: 11/27/96

00013

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	Hart Crowser, Inc.	**Service Request:**	K9607334
Project:	Port of Portland/5589	**Date Collected:**	11/14/96
Sample Matrix	Sediment	**Date Received:**	11/14/96
		Date Analyzed:	11/27/96

Particle Size Determination
Puget Sound Estuary Program Protocol

Sample Name: HC-T1-01
Lab Code: K9607334-008

Sand Fraction:	Dry Weight (Grams)	9.0165
Sand Fraction:	Weight Recovered (Grams)	9.1680
Sand Fraction:	Percent Recovery	102

Description	Phi Size	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel	<-1 Ø	0.0031	0.01
Very Coarse Sand	-1 to 0 Ø	0.0215	0.07
Coarse Sand	0 to 1 Ø	0.0530	0.18
Medium Sand	1 to 2 Ø	0.1199	0.41
Fine Sand	2 to 3 Ø	1.6280	5.52
Very Fine Sand	3 to 4 Ø	5.4923	18.6
Silt	4 to 8 Ø	18.6750	63.3
Clay	> 8 Ø	3.4050	11.5
	Total	29.3978	99.7

Approved By: _____ Date: 11/27/96

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	Hart Crowser, Inc.	**Service Request:**	K9607334
Project:	Port of Portland/5589	**Date Collected:**	11/14/96
Sample Matrix	Sediment	**Date Received:**	11/14/96
		Date Analyzed:	11/27/96

Particle Size Determination
Puget Sound Estuary Program Protocol

Sample Name: HC-T1-02
Lab Code: K9607334-009

Sand Fraction:	Dry Weight (Grams)	10.7342
Sand Fraction:	Weight Recovered (Grams)	10.9062
Sand Fraction:	Percent Recovery	102

Description	Phi Size	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel	<-1 Ø	0.0237	0.08
Very Coarse Sand	-1 to 0 Ø	0.0458	0.15
Coarse Sand	0 to 1 Ø	0.1051	0.34
Medium Sand	1 to 2 Ø	0.2341	0.75
Fine Sand	2 to 3 Ø	2.6362	8.50
Very Fine Sand	3 to 4 Ø	5.7623	18.6
Silt	4 to 8 Ø	20.3200	65.5
Clay	> 8 Ø	2.3550	7.59
	Total	31.4822	102

Approved By: _____ Date: 11/27/96

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	Hart Crowser, Inc.	**Service Request:**	K9607334
Project:	Port of Portland/5589	**Date Collected:**	11/14/96
Sample Matrix	Sediment	**Date Received:**	11/14/96
		Date Analyzed:	11/27/96

Particle Size Determination
Puget Sound Estuary Program Protocol

Sample Name: HC-T5-02
Lab Code: K9607334-010

Sand Fraction:	Dry Weight (Grams)	73.3052
Sand Fraction:	Weight Recovered (Grams)	73.8762
Sand Fraction:	Percent Recovery	101

Description	Phi Size	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel	<-1 Ø	0.9170	1.25
Very Coarse Sand	-1 to 0 Ø	1.8892	2.58
Coarse Sand	0 to 1 Ø	5.9226	8.07
Medium Sand	1 to 2 Ø	33.3969	45.5
Fine Sand	2 to 3 Ø	27.7056	37.8
Very Fine Sand	3 to 4 Ø	3.9091	5.33
Silt	4 to 8 Ø	1.2800	1.75
Clay	> 8 Ø	0.4100	0.56
	Total	75.4304	103

Approved By: _____ Date: 11/27/96

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

lient: Hart Crowser, Inc.
roject: Port of Portland/5589
ample Matrix: Sediment

Service Request: K9607334
Date Collected: 11/13,14/96
Date Received: 11/13,14/96
Date Extracted: 11/22/96

Total Metals
Units: mg/Kg (ppm)
Dry Weight Basis

	Sample Name:	HC-T5-01	HC-T2-02	HC-T2-02 Dup
	Lab Code:	K9607334-002	K9607334-003	K9607334-004
	Date Analyzed:	11/26, 12/2/96	11/26, 12/2/96	11/26, 12/2/96
nalyte	**EPA Method**	**MRL**		
rsenic	200.8	1	3	4
admium	200.8	0.02	0.16	0.16
opper	200.8	0.1	18.9	31.2
ead	200.8	0.02	6.37	13.5
ercury	7471	0.05	ND UJ	0.06 J
ickel	200.8	0.2	17.7	21.6
ilver	200.8	0.02	0.04	0.15
inc	200.8	0.5	60.5	73.8

12.17.96
KCT

Approved By: _____ Date: 12/3/96

330EPA/102094
07334ICP.GJ1 - Sample 12/3/96

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: Hart Crowser, Inc.
Project: Port of Portland/5589
Sample Matrix: Sediment

Service Request: K9607334
Date Collected: 11/13,14/96
Date Received: 11/13,14/96
Date Extracted: 11/22/96

Total Metals
Units: mg/Kg (ppm)
Dry Weight Basis

	Sample Name:	HC-T2-03	HC-T2-01	HC-T1-01
	Lab Code:	K9607334-005	K9607334-007	K9607334-008
	Date Analyzed:	11/26, 12/2/96	11/26, 12/2/96	11/26, 12/2/96
Analyte	**EPA Method**	**MRL**		
Arsenic	200.8	1	3	4	4
Cadmium	200.8	0.02	0.16	0.16	0.18
Copper	200.8	0.1	32.1	32.7	34.5
Lead	200.8	0.02	31.9	13.9	15.6
Mercury	7471	0.05	0.12 J	0.07 J	0.08 J
Nickel	200.8	0.2	17.4	19.8	23.0
Silver	200.8	0.02	0.21	0.16	0.20
Zinc	200.8	0.5	74.4	72.3	81.0

12-17-96
KCT

Approved By: _____ Date: 12/3/96

3S30EPA/102094
073341CP.GJ1 - Sample (2) 12/3/96

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: Hart Crowser, Inc.
Project: Port of Portland/5589
Sample Matrix: Sediment

Service Request: K9607334
Date Collected: 11/13,14/96
Date Received: 11/13,14/96
Date Extracted: 11/22/96

Total Metals
Units: mg/Kg (ppm)
Dry Weight Basis

		Sample Name:	HC-T1-02	HC-T5-02	Method Blank
		Lab Code:	K9607334-009	K9607334-010	K9607334-MB
		Date Analyzed:	11/26, 12/2/96	11/26, 12/2/96	11/26, 12/2/96
Analyte	**EPA Method**	**MRL**			
Arsenic	200.8	1	4	3	ND
Cadmium	200.8	0.02	0.17	0.17	ND
Copper	200.8	0.1	34.0	10.2	ND
Lead	200.8	0.02	15.8	4.80	ND
Mercury	7471	0.05	0.07 J	ND J	ND J
Nickel	200.8	0.2	22.7	12.9	ND
Silver	200.8	0.02	0.22	0.03	ND
Zinc	200.8	0.5	81.3	63.7	ND

12-17-96
ICC

Approved By: _____ Date: 12/3/96

3S30EPA/102094
07334ICP.GJ1 - Sample (3) 12/3/96

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: Hart Crowser, Inc.
Project: Port of Portland/5589
Sample Matrix: Sediment

Service Request: K9607334
Date Collected: 11/13/96
Date Received: 11/13-14/96
Date Extracted: 11/20/96

Organochlorine Pesticides and Polychlorinated Biphenyls (PCBs) - Low Level
EPA Methods 3550A/8080A
Units: ug/Kg (ppb)
Dry Weight Basis

Sample Name:		HC-T2-02	HC-T2-02 Dup	HC-T2-03
Lab Code:		K9607334-003	K9607334-004	K9607334-005
Date Analyzed:		11/27/96	11/27/96	11/27-12/3/96
Analyte	**MRL**			
alpha-BHC	2	ND	ND	ND
beta-BHC	2	ND	ND	ND
gamma-BHC (Lindane)	2	ND	ND	ND
delta-BHC	2	ND	ND	ND
Heptachlor	2	ND	ND	ND
Aldrin	2	ND	ND	ND
Heptachlor Epoxide	2	ND	ND	ND
Endosulfan I	2	ND	ND	ND
Dieldrin	2	ND	ND	ND
4,4'-DDE	2	ND	ND	2
Endrin	2	ND	ND	ND
Endosulfan II	2	ND	ND	ND
4,4'-DDD	2	ND	ND	ND
Endrin Aldehyde	2	ND	ND	ND
Endosulfan Sulfate	2	ND	ND	ND
4,4'-DDT	2	ND	ND	ND
Methoxychlor	4	ND	ND	ND
Toxaphene	30	ND	ND	ND
Chlordane	10	ND	ND	ND
Aroclor 1016	10	ND	ND	ND
Aroclor 1221	10	ND	ND	ND
Aroclor 1232	10	ND	ND	ND
Aroclor 1242	10	ND	ND	ND
Aroclor 1248	10	ND	ND	ND
Aroclor 1254	10	ND	ND	71
Aroclor 1260	10	ND	ND	28

Approved By: Wanda J Nagel Date: 12/3/96

3S30/120594

07334SVG JS2 - 3-5 12/3/96

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	Hart Crowser, Inc.	**Service Request:**	K9607334
Project:	Port of Portland/5589	**Date Collected:**	11/13/96
Sample Matrix:	Sediment	**Date Received:**	11/13-14/96
		Date Extracted:	11/20/96

Organochlorine Pesticides and Polychlorinated Biphenyls (PCBs) - Low Level
EPA Methods 3550A/8080A
Units: ug/Kg (ppb)
Dry Weight Basis

	Sample Name:	HC-T2-01	HC-T1-01	HC-T1-02
	Lab Code:	K9607334-007	K9607334-008	K9607334-009
	Date Analyzed:	11/27/96	11/27/96	11/27/96
Analyte	**MRL**			
alpha-BHC	2	ND	ND	ND
beta-BHC	2	ND	ND	ND
gamma-BHC (Lindane)	2	ND	ND	ND
delta-BHC	2	ND	ND	ND
Heptachlor	2	ND	ND	ND
Aldrin	2	ND	ND	ND
Heptachlor Epoxide	2	ND	ND	ND
Endosulfan I	2	ND	ND	ND
Dieldrin	2	ND	ND	ND
4,4'-DDE	2	ND	ND	ND
Endrin	2	ND	ND	ND
Endosulfan II	2	ND	ND	ND
4,4'-DDD	2	ND	ND	ND
Endrin Aldehyde	2	ND	ND	ND
Endosulfan Sulfate	2	ND	ND	ND
4,4'-DDT	2	ND	ND	ND
Methoxychlor	4	<7 B	ND	ND
Toxaphene	30	ND	ND	ND
Chlordane	10	ND	ND	ND
Aroclor 1016	10	ND	ND	ND
Aroclor 1221	10	ND	ND	ND
Aroclor 1232	10	ND	ND	ND
Aroclor 1242	10	ND	ND	ND
Aroclor 1248	10	ND	ND	ND
Aroclor 1254	10	ND	ND	ND
Aroclor 1260	10	ND	ND	ND

B The MRL is elevated because of matrix interferences.

Approved By: Wanda J Nagel Date: 12/3/96

3S30/120594

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	Hart Crowser, Inc.	Service Request:	K9607334
Project:	Port of Portland/5589	Date Collected:	11/13/96
Sample Matrix:	Sediment	Date Received:	11/13-14/96
		Date Extracted:	11/20/96

Organochlorine Pesticides and Polychlorinated Biphenyls (PCBs) - Low Level
EPA Methods 3550A/8080A
Units: ug/Kg (ppb)
Dry Weight Basis

	Sample Name:	HC-T5-02	Method Blank
	Lab Code:	K9607334-010	K961120-SB
	Date Analyzed:	11/27,28/96	11/27/96
Analyte	**MRL**		
alpha-BHC	2	ND	ND
beta-BHC	2	ND	ND
gamma-BHC (Lindane)	2	ND	ND
delta-BHC	2	ND	ND
Heptachlor	2	ND	ND
Aldrin	2	ND	ND
Heptachlor Epoxide	2	ND	ND
Endosulfan I	2	ND	ND
Dieldrin	2	ND	ND
4,4'-DDE	2	ND	ND
Endrin	2	ND	ND
Endosulfan II	2	ND	ND
4,4'-DDD	2	ND	ND
Endrin Aldehyde	2	ND	ND
Endosulfan Sulfate	2	ND	ND
4,4'-DDT	2	ND	ND
Methoxychlor	4	ND	ND
Toxaphene	30	ND	ND
Chlordane	10	ND	ND
Aroclor 1016	10	ND	ND
Aroclor 1221	10	ND	ND
Aroclor 1232	10	ND	ND
Aroclor 1242	10	ND	ND
Aroclor 1248	10	ND	ND
Aroclor 1254	10	ND	ND
Aroclor 1260	10	ND	ND

Approved By: Wanda J Nagel Date: 12/3/96

3S30/120594

07334SVG JS2 - 10_MB 12/3/96

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	Hart Crowser, Inc.	**Service Request:**	K9607334
Project:	Port of Portland/5589	**Date Collected:**	11/13/96
Sample Matrix:	Sediment	**Date Received:**	11/13-14/96
		Date Extracted:	11/26/96

Organochlorine Pesticides and Polychlorinated Biphenyls (PCBs) - Low Level
EPA Methods 3550A/8080A
Units: ug/Kg (ppb)
Dry Weight Basis

		Sample Name:	HC-T5-01	Method Blank
		Lab Code:	K9607334-002	K961126-MB
		Date Analyzed:	11/28-12/1/96	11/28-12/1/96
Analyte	**MRL**			
alpha-BHC	2		ND	ND
beta-BHC	2		ND	ND
gamma-BHC (Lindane)	2		ND	ND
delta-BHC	2		ND	ND
Heptachlor	2		ND	ND
Aldrin	2		ND	ND
Heptachlor Epoxide	2		ND	ND
Endosulfan I	2		ND	ND
Dieldrin	2		ND	ND
4,4'-DDE	2		ND	ND
Endrin	2		ND	ND
Endosulfan II	2		ND	ND
4,4'-DDD	2		ND	ND
Endrin Aldehyde	2		ND	ND
Endosulfan Sulfate	2		ND	ND
4,4'-DDT	2		ND	ND
Methoxychlor	4		ND	ND
Toxaphene	30		ND	ND
Chlordane	10		ND	ND
Aroclor 1016	10		ND	ND
Aroclor 1221	10		ND	ND
Aroclor 1232	10		ND	ND
Aroclor 1242	10		ND	ND
Aroclor 1248	10		ND	ND
Aroclor 1254	10		ND	ND
Aroclor 1260	10		ND	ND

Approved By: Wanda J. Nagel Date: 12/3/96

3S30/120594

07334SVG JJ1 - 1-3 12/3/96

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	Hart Crowser, Inc.	**Service Request:**	K9607334
Project:	Port of Portland/5589	**Date Collected:**	11/13,14/96
Sample Matrix:	Sediment	**Date Received:**	11/13,14/96
		Date Extracted:	11/19/96

Butyltins*
Units: ug/Kg (ppb)
Dry Weight Basis

Analyte:	Tributyltin	Dibutyltin	Tetra-n-butyltin
Method Reporting Limit:	1	1	1

Sample Name	Lab Code	Date Analyzed			
HC-T5-01	K9607334-002	11/27/96	15	ND	ND
HC-T2-02	K9607334-003	11/27/96	20	ND	ND
HC-T2-02 Dup	K9607334-004	11/27/96	24	1	1
HC-T2-03	K9607334-005	11/27/96	35	2	ND
HC-T2-01	K9607334-007	11/27/96	10	ND	ND
HC-T1-01	K9607334-008	11/27/96	13	2	ND
HC-T1-02	K9607334-009	11/27/96	8	ND	ND
HC-T5-02	K9607334-010	11/27/96	190	5	2
Method Blank	K961119-SB	11/27/96	ND	ND	ND

* Methodology based on C.A.Krone, et al., "A Method for Analysis of Butyltin Species and Measurement of Butyltins in Sediment and English Sole Livers from Puget Sound," National Marine Fisheries Service, National Oceanic and Atmospheric Administration. Seattle, WA, November 1988.

Approved By: _____ Date: 12-4-96

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

ient: Hart Crowser, Inc.
oject: Port of Portland/5589
mple Matrix: Sediment

Service Request: K9607334
Date Collected: 11/13/96
Date Received: 11/13-14/96
Date Extracted: 11/27/96

Polynuclear Aromatic Hydrocarbons and Phenols
EPA Method 3550A in combination with GC/MS SIM Method
Units: µg/Kg (ppb)
Dry Weight Basis

Sample Name:		HC-T5-01	HC-T2-02	HC-T2-02 Dup
Lab Code:		K9607334-002	K9607334-003	K9607334-004
Date Analyzed:		12/3/96	12/3/96	12/3/96
alyte	MRL			
aphthalene	10	ND	ND	ND
Methylnaphthalene	10	ND	ND	ND
enaphthylene	10	ND	ND	ND
enaphthene	10	ND	ND	ND
uorene	10	ND	ND	ND
enanthrene	10	13	36	28
nthracene	10	ND	ND	ND
uoranthene	10	52 J	71	41
rene	10	60 J	77 J	43 J
nz(a)anthracene	10	69	26	21
rysene	10	79	34	28
nzo(b)fluoranthene	10	38	25	20
nzo(k)fluoranthene	10	41	21	17
nzo(a)pyrene	10	36	33	22
deno(1,2,3-cd)pyrene	10	20	29	17
ibenz(a,h)anthracene	10	ND	ND	ND
nzo(g,h,i)perylene	10	15	31	18
enol	50	ND	ND	ND
-Methylphenol	50	ND	ND	ND
and 4-Methylphenol*	50	ND	ND	ND
4-Dimethylphenol	50	ND	ND	ND
ntachlorophenol	50	ND	ND	ND

12.17.96
ICET

pproved By: _____ Date: 12/18/96

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K967334E.XLS - 2-4 12/12/96

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: Hart Crowser, Inc.
Project: Port of Portland/5589
Sample Matrix: Sediment

Service Request: K9607334
Date Collected: 11/13-14/96
Date Received: 11/13-14/96
Date Extracted: 11/27/96

Polynuclear Aromatic Hydrocarbons and Phenols
EPA Method 3550A in combination with GC/MS SIM Method
Units: µg/Kg (ppb)
Dry Weight Basis

Sample Name:		HC-T2-03	HC-T2-01	HC-T1-01
Lab Code:		K9607334-005	K9607334-007	K9607334-008
Date Analyzed:		12/3/96	12/3/96	12/3/96
Analyte	**MRL**			
Naphthalene	10	46	ND	ND
2-Methylnaphthalene	10	19	ND	ND
Acenaphthylene	10	11	ND	ND
Acenaphthene	10	56	ND	19
Fluorene	10	27	ND	14
Phenanthrene	10	166	34	56
Anthracene	10	32	ND	ND
Fluoranthene	10	152	59	57
Pyrene	10	184 J	59 J	57 J
Benz(a)anthracene	10	61	38	27
Chrysene	10	69	48	35
Benzo(b)fluoranthene	10	45	33	23
Benzo(k)fluoranthene	10	42	28	20
Benzo(a)pyrene	10	70	36	25
Indeno(1,2,3-cd)pyrene	10	54	25	19
Dibenz(a,h)anthracene	10	ND	ND	ND
Benzo(g,h,i)perylene	10	59	25	21
Phenol	50	ND	ND	ND
2-Methylphenol	50	ND	ND	ND
3- and 4-Methylphenol*	50	ND	ND	ND
2,4-Dimethylphenol	50	ND	ND	ND
Pentachlorophenol	50	ND	ND	ND

12.17.96
KCA

Approved By: TR Date: 12/10/96

3530/120594

07334SVM.JS1 - 3,7,8 12/10/96

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: Hart Crowser, Inc.
Project: Port of Portland/5589
Sample Matrix: Sediment

Service Request: K9607334
Date Collected: 11/14/96
Date Received: 11/13-14/96
Date Extracted: 11/27/96

Polynuclear Aromatic Hydrocarbons and Phenols
EPA Method 3550A in combination with GC/MS SIM Method
Units: µg/Kg (ppb)
Dry Weight Basis

	Sample Name:	HC-T1-02	HC-T5-02	Method Blank
	Lab Code:	K9607334-009	K9607334-010	K961127-SB1
	Date Analyzed:	12/3/96	12/3/96	12/2/96
Analyte	**MRL**			
Naphthalene	10	ND	ND	ND
2-Methylnaphthalene	10	ND	ND	ND
Acenaphthylene	10	ND	ND	ND
Acenaphthene	10	ND	ND	ND
Fluorene	10	ND	ND	ND
Phenanthrene	10	20	ND	ND
Anthracene	10	ND	ND	ND
Fluoranthene	10	32	ND	ND
Pyrene	10	35 J	ND a J	ND
Benz(a)anthracene	10	19	ND	ND
Chrysene	10	29	ND	ND
Benzo(b)fluoranthene	10	20	ND	ND
Benzo(k)fluoranthene	10	15	ND	ND
Benzo(a)pyrene	10	18	ND	ND
Indeno(1,2,3-cd)pyrene	10	14	ND	ND
Dibenz(a,h)anthracene	10	ND	ND	ND
Benzo(g,h,i)perylene	10	16	ND	ND
Phenol	50	ND	ND	ND
2-Methylphenol	50	ND	ND	ND
3- and 4-Methylphenol*	50	ND	ND	ND
2,4-Dimethylphenol	50	ND	ND	ND
Pentachlorophenol	50	ND	ND	ND

KCA
12-17-96

Approved By: _____ Date: 12/10/96

3S30/120594

07334SVM.JS1 - 9.10_MB 12/6/96

APPENDIX A
LABORATORY QA/QC RESULTS

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: Hart Crowser, Inc.
Project: Port of Portland/5589
Sample Matrix: Sediment

Service Request: K9607334
Date Collected: 11/13/96
Date Received: 11/13/96
Date Extracted: NA

Duplicate Summary
Inorganic Parameters
Units: mg/Kg (ppm)
Dry Weight Basis

Sample Name: HC-T2-03
Lab Code: K9607334-005D

Analyte	EPA Method	MRL	Sample Result	Duplicate Sample Result	Average	Relative Percent Difference
Ammonia as Nitrogen*	350.1M	0.5	190	190	190	< 1
Sulfide, Total	PSEP	0.5	11	5.9	8.40	61
Total Organic Carbon (%)	ASTM D4129-82	0.05	0.53 (L)	0.46	0.50	14

* Analysis was performed on a 2M KCl extract.
L Duplicate analysis was performed on Sample HC-T5-01; Lab Code K9607334-002.

Approved By: _____ Date: 12/19/96

DUP1SEPA/102194
07334WET.LI1 - MixedDup 12/9/96

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: Hart Crowser, Inc.
Project: Port of Portland/5589
Sample Matrix: Sediment

Service Request: K9607334
Date Collected: 11/13/96
Date Received: 11/13/96
Date Extracted: NA

Matrix Spike Summary
Inorganic Parameters
Units: mg/Kg (ppm)
Dry Weight Basis

Sample Name: HC-T2-03
Lab Code: K9607334-005MS

Analyte	EPA Method	MRL	Spike Level	Sample Result	Spiked Sample Result	Percent Recovery	CAS Percent Recovery Acceptance Limits
Ammonia as Nitrogen*	350.1M	0.5	450	190	610	93	75-125
Sulfide, Total	PSEP	0.5	430	11	330	74	60-125
Total Organic Carbon (%)	ASTM D4129-82M	0.05	6.37 (M)	0.53	6.84	99	75-125

Analysis was performed on a 2M KCl extract.
Matrix spike analysis was performed on Sample HC-T5-01; Lab Code K9607334-002.

Approved By: _____ Date: 12/11/96

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: Hart Crowser, Inc.
Project: Port of Portland/5589
Sample Matrix: Sediment

Service Request: K9607334
Date Collected: 11/13,14/96
Date Received: 11/13,14/96
Date Extracted: 11/22/96
Date Analyzed: 11/26, 12/2/96

Duplicate Summary
Total Metals
Units: mg/Kg (ppm)
Dry Weight Basis

Sample Name: HC-T5-01
Lab Code: K9607334-002

Analyte	EPA Method	MRL	Sample Result	Duplicate Sample Result	Average	Relative Percent Difference
Arsenic	200.8	1	3	4	4	25
Cadmium	200.8	0.02	0.16	0.17	0.16	6
Copper	200.8	0.1	18.9	19.0	19.0	1
Lead	200.8	0.02	6.37	6.41	6.39	1
Mercury	7471	0.05	0.12	0.23	0.18	61
Nickel	200.8	0.2	17.7	18.6	18.2	6
Silver	200.8	0.02	0.04	0.04	0.04	<1
Zinc	200.8	0.5	60.5	61.5	61.0	2

Approved By: _____ Date: 12/3/96

XUP1SEPA/102194

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: Hart Crowser, Inc.
Project: Port of Portland/5589
Sample Matrix: Sediment

Service Request: K9607334
Date Collected: 11/13,14/96
Date Received: 11/13,14/96
Date Extracted: 11/22/96
Date Analyzed: 11/26, 12/2/96

Matrix Spike Summary
Total Metals
Units: mg/Kg (ppm)
Dry Weight Basis

Sample Name: HC-T5-01
Lab Code: K9607334-002

Analyte	MRL	Spike Level	Sample Result	Spiked Sample Result	Percent Recovery	CAS Percent Recovery Acceptance Limits
Arsenic	1	30	3	26	77	60-130
Cadmium	0.02	7.4	0.16	6.11	80	60-130
Copper	0.1	37	18.9	49.2	82	60-130
Lead	0.02	74	6.37	81.6	102	60-130
Mercury	0.05	0.45	0.12	0.59	104	60-130
Nickel	0.2	74	17.7	79.3	83	60-130
Silver	0.02	7.4	0.04	5.78	78	60-130
Zinc	0.5	74	60.5	119	79	60-130

Approved By: _____ Date: 12/3/96

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client:	Hart Crowser, Inc.	**Service Request:**	K9607334
Project:	Port of Portland/5589	**Date Collected:**	11/13/96
Sample Matrix:	Sediment	**Date Received:**	11/13-14/96
		Date Extracted:	11/20/96
		Date Analyzed:	11/27/96

Surrogate Recovery Summary
Organochlorine Pesticides and Polychlorinated Biphenyls (PCBs) - Low Level
EPA Methods 3550A/8080A

Sample Name	Lab Code	Percent Recovery Tetrachloro-m-xylene	Percent Recovery Decachlorobiphenyl
HC-T2-02	K9607334-003	42	57
HC-T2-02 Dup	K9607334-004	31	44
HC-T2-03	K9607334-005	40	53
HC-T2-01	K9607334-007	42	53
HC-T1-01	K9607334-008	49	65
HC-T1-02	K9607334-009	40	48
HC-T5-02	K9607334-010	47	67
HC-T2-03	K9607334-005MS	48	61
HC-T2-03	K9607334-005DMS	42	58
Method Blank	K961120-SB	5 A	64
CAS Acceptance Limits:		20-107	20-142

A Outside acceptance limits; see case narrative.

Approved By: _____ Date: 12/3/96

SUR2/120594
07334SVG.ST2 - SUR2 12/2/96

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client:	Hart Crowser, Inc.	**Service Request:**	K9607334
Project:	Port of Portland/5589	**Date Collected:**	11/13/96
Sample Matrix:	Sediment	**Date Received:**	11/13-14/96
		Date Extracted:	11/26/96
		Date Analyzed:	12/1/96

Surrogate Recovery Summary
Organochlorine Pesticides and Polychlorinated Biphenyls (PCBs) - Low Level
EPA Methods 3550A/8080A

Sample Name	Lab Code	Percent Recovery Tetrachloro-m-xylene	Percent Recovery Decachlorobiphenyl
HC-T5-01	K9607334-002	48	77
Lab Control Sample	K961126-LCS	51	74
Method Blank	K961126-MB	44	80

CAS Acceptance Limits: 20-107 20-142

Approved By: Wanda J Nagel Date: 12/3/96

SUR2/120594
07334SVG.JJ1 - SUR2 12/3/96

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: Hart Crowser, Inc.
Project: Port of Portland/5589
Sample Matrix: Sediment

Service Request: K9607334
Date Collected: 11/13/96
Date Received: 11/13-14/96
Date Extracted: 11/20/96
Date Analyzed: 11/27/96

Matrix Spike/Duplicate Matrix Spike Summary
Organochlorine Pesticides and Polychlorinated Biphenyls (PCBs) - Low Level
EPA Methods 3550A/8080A
Units: ug/Kg (ppb)
Dry Weight Basis

Sample Name: HC-T2-03
Lab Code: K9607334-005MS, K9607334-005DMS

Analyte	Spike Level MS	Spike Level DMS	Sample Result	Spike Result MS	Spike Result DMS	Percent Recovery MS	Percent Recovery DMS	CAS Acceptance Limits	Relative Percent Difference
gamma-BHC (Lindane)	13	13	ND	5.0	5.7	38	44	20-141	12
Heptachlor	13	13	ND	6.6	7.3	51	56	20-108	10
Aldrin	13	13	ND	6.0	5.4	46	42	20-181	11
Dieldrin	13	13	ND	8.4	8.8	65	68	20-183	5
Endrin	13	13	ND	8.3	9.2	64	71	20-164	10
4,4'-DDT	13	13	ND	8.9	9.4	68	72	20-185	5

Approved By: _____ Date: 12/3/96

DMS1S/120594
07334SVG.JS2 - SDMS 12/2/96

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: Hart Crowser, Inc.
Project: Port of Portland/5589
LCS Matrix: Sediment

Service Request: K9607334
Date Collected: NA
Date Received: NA
Date Extracted: 11/26/96
Date Analyzed: 12/1/96

Laboratory Control Sample Summary
Organochlorine Pesticides and Polychlorinated Biphenyls (PCBs) - Low Level
EPA Methods 3550A/8080A
Units: ug/Kg (ppb)

Analyte	True Value	Result	Percent Recovery	CAS Percent Recovery Acceptance Limits
gamma-BHC (Lindane)	12	11	92	21-123
Heptachlor	12	12	100	31-112
Aldrin	12	10	83	26-127
Dieldrin	12	12	100	18-161
Endrin	12	12	100	32-135
4,4'-DDT	12	14	117	30-146

Approved By: Wanda J Nagel Date: 12/3/96

LCS/121594
07334SVG.JJ1 - LCS 12/3/96

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: Hart Crowser, Inc.
Project: Port of Portland/5589
Sample Matrix: Sediment

Service Request: K9607334
Date Collected: 11/13,14/96
Date Received: 11/13,14/96
Date Extracted: 11/19/96
Date Analyzed: 11/27/96

Surrogate Recovery Summary
Butyltins

Sample Name	Lab Code	Percent Recovery Tripropyltin	Percent Recovery Tripentyltin
HC-T5-01	K9607334-002	80	58
HC-T2-02	K9607334-003	71	52
HC-T2-02 Dup	K9607334-004	73	56
HC-T2-03	K9607334-005	58	44
HC-T2-01	K9607334-007	69	53
HC-T1-01	K9607334-008	63	43
HC-T1-02	K9607334-009	71	53
HC-T5-02	K9607334-010	91	67
HC-T2-03	K9607334-005MS	83	61
HC-T2-03	K9607334-005DMS	72	57
Lab Control Sample	K961119-LCS	85	66
Method Blank	K961119-SB	76	62
CAS Acceptance Limits:		20-195	20-172

Approved By: Joy Date: 12-4-96

SUR3/102194
07334SVG.DDI - SURR 12/4/96

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client:	Hart Crowser, Inc.	**Service Request:**	K9607334
Project:	Port of Portland/5589	**Date Collected:**	11/13,14/96
Sample Matrix:	Sediment	**Date Received:**	11/13,14/96
		Date Extracted:	11/19/96
		Date Analyzed:	11/27/96

Matrix Spike/Duplicate Matrix Spike Summary
Butyltins
Units: ug/Kg (ppb)
Date Weight Basis

Sample Name: HC-T2-03
Lab Code: K9607334-005MS, K9607334-005DMS

Analyte	Spike Level MS	Spike Level DMS	Sample Result	Spike Result MS	Spike Result DMS	Percent Recovery MS	Percent Recovery DMS	CAS Acceptance Limits	Relative Percent Difference
Tributyltin	18	18	35	NA	NA	NC	NC	20-200	NC
Dibutyltin	18	18	5	8	10	17	28	NA	22
Tetra-n-butyltin	18	18	NA	16	15	89	83	NA	6

NA Not Applicable; see case narrative.

Approved By: _____ Date: 12-4-96

DMS1SOTS/060194
07334SVG DD1 - DMS 12/4/96

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client:	Hart Crowser, Inc.	Service Request:	K9607334
Project:	Port of Portland/5589	Date Collected:	NA
LCS Matrix:	Sediment	Date Received:	NA
		Date Extracted:	11/19/96
		Date Analyzed:	11/27/96

Laboratory Control Sample Summary
Butyltins
Units: ug/Kg (ppb)

Analyte	True Value	Result	Percent Recovery	CAS Percent Recovery Acceptance Limits
Tributyltin	9.9	8.8	89	20-164
Dibutyltin	9.9	4.7	47	NA
Tetra-n-butyltin	9.9	8.8	89	NA

Approved By: _____ Date: 12-4-96

LCSOTS/121594
07334SVG.DD1 - LCS 12/4/96

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: Hart Crowser, Inc.
Project: Port of Portland/5589
Sample Matrix: Sediment

Service Request: K9607334
Date Collected: 11/13-14/96
Date Received: 11/13-14/96
Date Extracted: 11/27/96
Date Analyzed: 12/2-3/96

Surrogate Recovery Summary
Polynuclear Aromatic Hydrocarbons and Phenols
EPA Method 3550A in combination with GC/MS SIM Method

Sample Name	Lab Code	Percent Recovery 2FP	PHL	TBP	NBZ	FBP	TPH
HC-T5-01	K9607334-002	51	47	54	45	51	53
HC-T2-02	K9607334-003	36	35	65	33	40	59
HC-T2-02 Dup	K9607334-004	30	31	67	28	34	59
HC-T2-03	K9607334-005	39	39	66	37	41	56
HC-T2-01	K9607334-007	44	46	65	43	53	64
HC-T1-01	K9607334-008	36	42	65	33	47	57
HC-T1-02	K9607334-009	44	44	63	44	49	56
HC-T5-02	K9607334-010	33	40	54	34	52	63
HC-T5-02	K9607334-010MS	51	38	52	56	63	68
HC-T5-02	K9607334-010DMS	70	70	58	65	68	68
Method Blank	K961127-SB1	73	78	57	64	60	100
CAS Acceptance Limits:		5-106	5-96	5-110	5-134	5-120	15-145

2FP	2-Fluorophenol
PHL	Phenol-d6
TBP	2,4,6-Tribromophenol
NBZ	Nitrobenzene-d5
FBP	2-Fluorobiphenyl
TPH	p-Terphenyl-d14

Approved By: _____ Date: 12/17/96

SUR6/120594

K967334E.XLS - SUR 12/12/96

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

lient:	Hart Crowser, Inc.	**Service Request:**	K9607334
roject:	Port of Portland/5589	**Date Collected:**	11/14/96
ample Matrix:	Sediment	**Date Received:**	11/13-14/96
		Date Extracted:	11/27/96
		Date Analyzed:	12/3/96

Matrix Spike/Duplicate Matrix Spike Summary
Polynuclear Aromatic Hydrocarbons and Phenols
EPA Method 3550A in combination with GC/MS SIM Method
Units: µg/Kg (ppb)
Dry Weight Basis

ample Name: HC-T5-02
ab Code: K9607334-010

	Spike Level		Sample	Spike Result		Percent Recovery		CAS Acceptance	Relative Percent
nalyte	MS	DMS	Result	MS	DMS	MS	DMS	Limits	Difference
cenaphthene	462	460	ND	309	298	67	65	43-117	3
yrene	462	460	ND	507	300	110	65	42-143	51
henol	694	690	ND	366	457	53	66	21-100	22
entachlorophenol	694	690	ND	368	425	53	62	18-112	16

) Detected at or above the method reporting limit.

Approved By: TR Date: 12/10/96

MS1S/120594
07334SVMJS1 - 10DMS 12/10/96

APPENDIX B
CHAIN OF CUSTODY

Sample Custody Record

DATE 11/13/96 PAGE 1 OF 1

HARTCROWSER

1910 Fairview Avenue East
Seattle, Washington 98102-3699

JOB NUMBER 5589 LAB NUMBER

PROJECT MANAGER Taku Fuji

PROJECT NAME Port of Portland

SAMPLED BY: Bob Hanford / Fuji

Date

LAB NO.	SAMPLE	TIME	STATION	MATRIX	TESTING: Metals	PCBs	LPAH's	HPAH's	BEP 623	Conventionals/Parameters					NO. OF CONTAINERS	OBSERVATIONS/COMMENTS/ COMPOSITING INSTRUCTIONS
	11/13/96	10:00	HC-TZ-01	Sed	X	X	X	X	X	X					3	
	11/13/96	11:30	HC-T5-01	Sed	X	X	X	X	X	X					3	
	11/13/96	12:30	HC-TZ-02	Sed	X	X	X	X	X	X					3	
	11/13/96	12:30	HC-TZ-02 Dup	Sed	X	X	X	X	X	X					3	
	11/13/96	14:30	HC-TZ-03	Sed	X	X	X	X	X	X					9	Includes QA/QC Volume.

RELINQUISHED BY	DATE	RECEIVED BY	DATE
SIGNATURE: Robert R. Hanford	11/13/96	SIGNATURE: [illegible]	
PRINTED NAME: Robert R. Hanford	TIME	PRINTED NAME: [illegible]	TIME
COMPANY: Hart Crowser	14:40	COMPANY: 11/13/96	1442
RELINQUISHED BY	DATE	RECEIVED BY	DATE
SIGNATURE		SIGNATURE	
PRINTED NAME	TIME	PRINTED NAME	TIME
COMPANY		COMPANY	

TOTAL NUMBER OF CONTAINERS: 21

METHOD OF SHIPMENT: Courier

SPECIAL SHIPMENT/HANDLING OR STORAGE REQUIREMENTS: All analysis as directed in TABLE 4 of Work Plan.

K960T334

DISTRIBUTION:

1. PROVIDE WHITE AND YELLOW COPIES TO LABORATORY
2. RETURN PINK COPY TO PROJECT MANAGER
3. LABORATORY TO FILL IN SAMPLE NUMBER AND SIGN FOR RECEIPT
4. LABORATORY TO RETURN WHITE COPY TO HART CROWSER

0004.3

Printed On Recycled Paper

Sample Custody Record

DATE [illegible] PAGE 1 OF 1

HARTCROWSER
[illegible] Inc
1910 Fairview Avenue East
Seattle, Washington 98102-3699

JOB NUMBER [illegible] LAB NUMBER

PROJECT MANAGER [illegible]

PROJECT NAME [illegible]

SAMPLED BY: [illegible]

LAB NO.	SAMPLE	TIME	STATION	MATRIX	TESTING	NO. OF CONTAINERS	OBSERVATIONS/COMMENTS/ COMPOSITING INSTRUCTIONS
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	

RELINQUISHED BY	DATE	RECEIVED BY	DATE
SIGNATURE [illegible]	[illegible]	SIGNATURE	
PRINTED NAME [illegible]	TIME	PRINTED NAME	TIME
COMPANY	[illegible]	COMPANY	

RELINQUISHED BY	DATE	RECEIVED BY	DATE
SIGNATURE		SIGNATURE	
PRINTED NAME	TIME	PRINTED NAME	TIME
COMPANY		COMPANY	

TOTAL NUMBER OF CONTAINERS [illegible]

METHOD OF SHIPMENT [illegible]

SPECIAL SHIPMENT/HANDLING OR STORAGE REQUIREMENTS [illegible]

DISTRIBUTION:

1. PROVIDE WHITE AND YELLOW COPIES TO LABORATORY
2. RETURN PINK COPY TO PROJECT MANAGER
3. LABORATORY TO FILL IN SAMPLE NUMBER AND SIGN FOR RECEIPT
4. LABORATORY TO RETURN WHITE COPY TO HART CROWSER

00045

Columbia Analytical Services -- Kelso
INTERNAL LOGIN SUMMARY REPORT (il01)
14-NOV-96 12:27

Service Req. No. K9607334
Client No. 080550
Client Name Hart Crowser, Inc.

Project No. 5589
Project Name Port of Portland

Bottles: 7 - 16 oz Glass
7 - 8 oz Glass
7 - Soil VOA

Bill To: Hart Crowser
Attn: Accounts Payable
1910 Fairview Avenue East
Seattle, WA 98102-3699

Report To: Hart Crowser, Inc.
Taku Fuji
1910 Fairview Avenue East
Seattle, WA 98102-3699

P.O. No.
Logged In By FADAIR
ISR Num
COC Received Y
Samples Submitted 13-NOV-96

Site ID
Project Chemist Abbie Spielman

Storage: SAMSON 46

CAS Samp No.	Client Sample No.	Matrix	Collected	DueDate	8080-L	GRAIN SIZE	HG/CVAA	HOLD	ICP/MS-7	NH3	S2-PSEP	SIM-TCL	TIN-SVG	TOC
K9607334-001	HC-T2-01	SEDIMENT	13-NOV-96	27-NOV-96				II						
K9607334-002	HC-T5-01	SEDIMENT	13-NOV-96	27-NOV-96	II	II	II		II	II	II	II	II	II
K9607334-003	HC-T2-02	SEDIMENT	13-NOV-96	27-NOV-96	II	II	II		II	II	II	II	II	II
K9607334-004	HC-T2-02 Dup	SEDIMENT	13-NOV-96	27-NOV-96	II	II	II		II	II	II	II	II	II
K9607334-005	HC-T2-03	SEDIMENT	13-NOV-96	27-NOV-96	II	II	II		II	II	II	II	II	II

See attached

Samples Found To Be Hazardous: NONE ALL *SOME

Reviewed By:

Sample Custody Record

DATE 11/14/96 PAGE 1 OF 1

HARTCROWSER

Hart Crowser, Inc.
1910 Fairview Avenue East
Seattle, Washington 98102-3699

JOB NUMBER 5589 LAB NUMBER

PROJECT MANAGER TAKU FUJI

PROJECT NAME PORT OF PORTLAND

SAMPLED BY: Rob Haviland

LAB NO.	SAMPLE	TIME	STATION	MATRIX	Metals	Phenols	LAHHs	HAHs	Pest/PCB	Conventionals/Petroleum					NO. OF CONTAINERS	OBSERVATIONS/COMMENTS/ COMPOSITING INSTRUCTIONS
334-6	11/14/96	0830	HC-T2-01	Sed	X	X	X	X	X	X					3	Composite with HC-T2-01 received 11/15/96
8	11/14/96	0930	HC-T1-01	Sed	X	X	X	X	X	X					3	
9	11/14/96	10:30	HC-T1-02	Sed	X	X	X	X	X	X					3	
10	11/14/96	15:10	HC-T5-02	Sed	X	X	X	X	X	X					3	

RELINQUISHED BY	DATE	RECEIVED BY	DATE
SIGNATURE	11/14/96	SIGNATURE	
PRINTED NAME	TIME	PRINTED NAME	TIME
COMPANY	16:47	COMPANY	

RELINQUISHED BY	DATE	RECEIVED BY	DATE
SIGNATURE		SIGNATURE	
PRINTED NAME	TIME	PRINTED NAME	TIME
COMPANY		COMPANY	

TOTAL NUMBER OF CONTAINERS 12

METHOD OF SHIPMENT Hand delivered

SPECIAL SHIPMENT/HANDLING OR STORAGE REQUIREMENTS 4°C
all analysis per Table 4 in workplan

DISTRIBUTION:

1. PROVIDE WHITE AND YELLOW COPIES TO LABORATORY
2. RETURN PINK COPY TO PROJECT MANAGER
3. LABORATORY TO FILL IN SAMPLE NUMBER AND SIGN FOR RECEIPT
4. LABORATORY TO RETURN WHITE COPY TO HART CROWSER

000046

APPENDIX B
SEDIMENT CORE LOGS

Key for Sediment Logs

Sample Description

Classification of soils in this report is based on visual field and laboratory observations which include density/consistency, moisture condition, grain size, and plasticity estimates and should not be construed to imply field nor laboratory testing unless presented herein. Visual–manual classification methods of ASTM D 2488 were used as an identification guide.

Soil descriptions consist of the following:
Density/consistency, moisture, color, minor constituents, MAJOR CONSTITUENT, additional remarks.

Density/Consistency

Soil density/consistency in borings is related primarily to the Standard Penetration Resistance.
Soil density/consistency in test pits is estimated based on visual observation and is presented parenthetically on the test pit logs.

SAND or GRAVEL Density	Standard Penetration Resistance (N) in Blows/Foot	SILT or CLAY Consistency	Standard Penetration Resistance (N) in Blows/Foot	Approximate Shear Strength in TSF
Very loose	0 – 4	Very soft	0 – 2	<0.125
Loose	4 – 10	Soft	2 – 4	0.125 – 0.25
Medium dense	10 – 30	Medium stiff	4 – 8	0.25 – 0.5
Dense	30 – 50	Stiff	8 – 15	0.5 – 1.0
Very dense	>50	Very stiff	15 – 30	1.0 – 2.0
		Hard	>30	>2.0

Moisture

Dry	Little perceptible moisture
Damp	Some perceptible moisture, probably below optimum
Moist	Probably near optimum moisture content
Wet	Much perceptible moisture, probably above optimum

Minor Constituents

	Estimated Percentage
Not identified in description	0 – 5
Slightly (clayey, silty, etc.)	5 – 12
Clayey, silty, sandy, gravelly	12 – 30
Very (clayey, silty, etc.)	30 – 50

Legends

Surface Sample Acceptability Criteria:

1. Overlying water is present
2. Water has low turbidity
3. Sampler is not overfilled
4. Surface is flat
5. Penetration depth is acceptable

Estimated Percentage of other Minor Constituents

(ie. shells, wood, organics, plastic, metal brick, refuse)

	Estimated Percentage
Dusting	Trace on Surface
Trace	0–5
Moderate	5–20
Substantial	20–50

HARTCROWSER

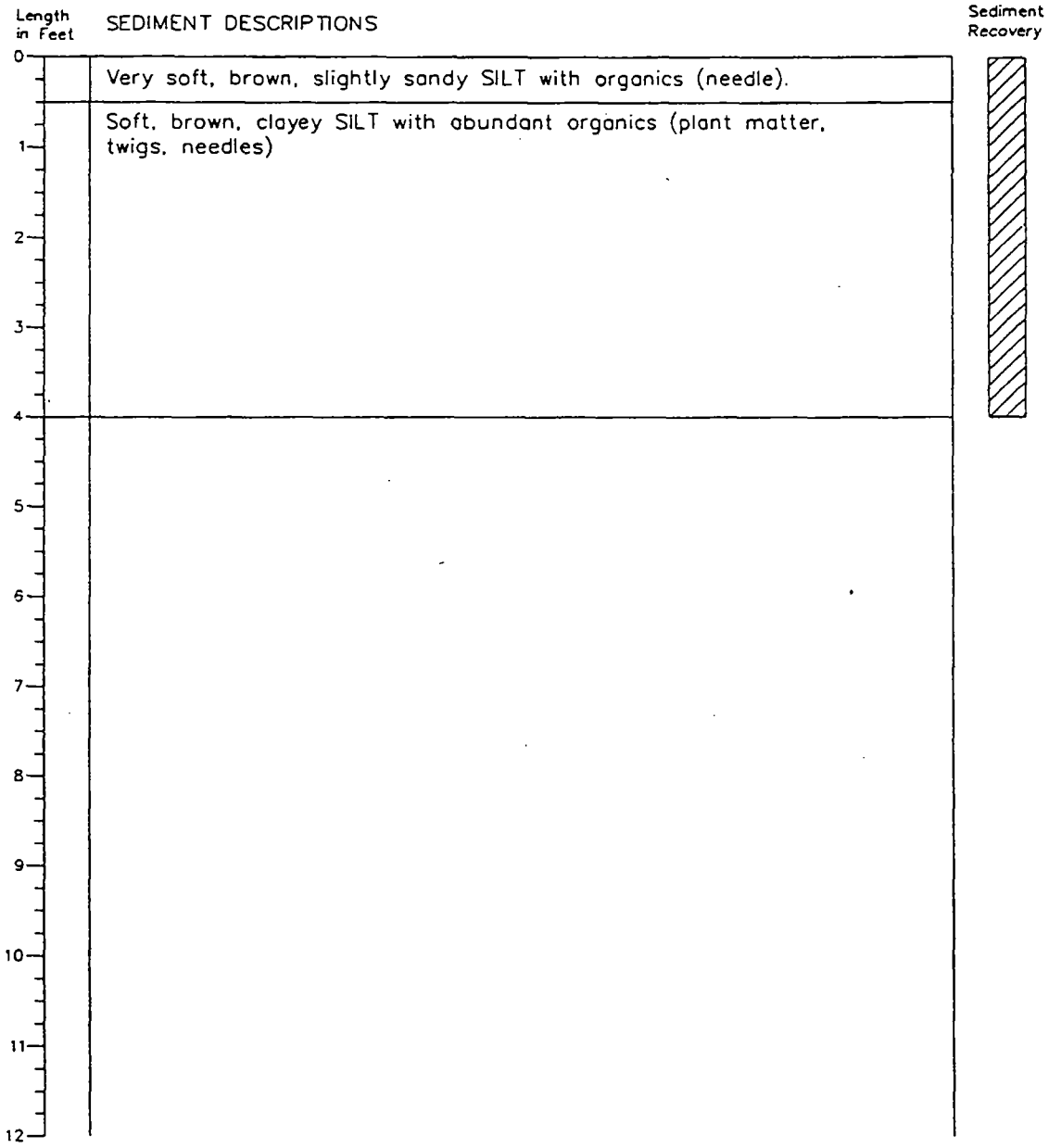
J-6589 1/97

Figure B-1

Sediment Core Log HC-GC-01

Type of Sample: Gravity Core
Date: 11/14/96
Recovery Length in Feet: 4.0
Mudline Elevation in Feet: −13.2 CRD

Northing: 690,785.51
Easting: 7,641,209.41
Drive Length in Feet: 5.5



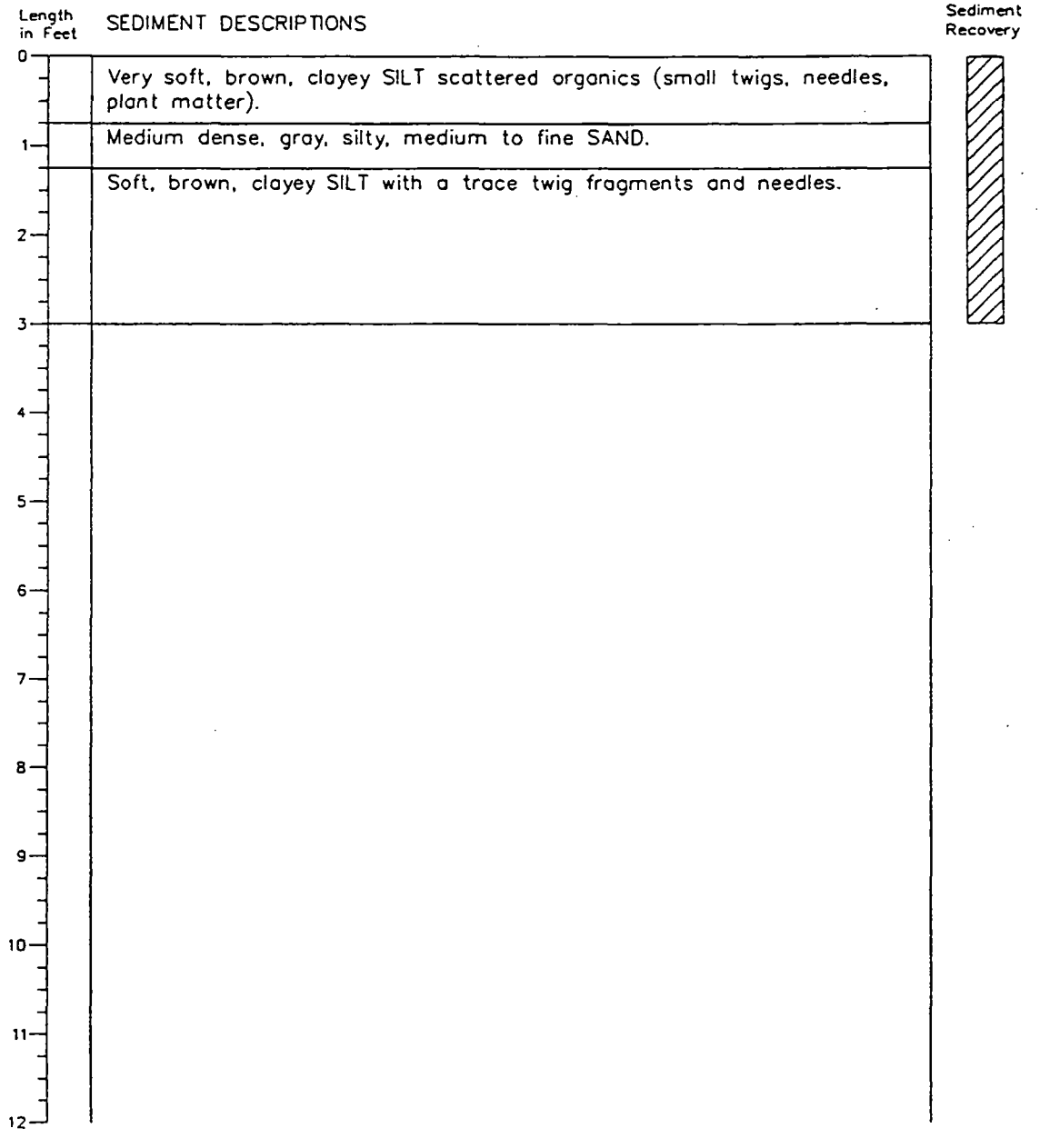
Note: Coordinates are NAD83 Oregon North Zone

HARTCROWSER
J-5589 11/96
Figure B-2

Sediment Core Log HC-GC-02

Type of Sample: Gravity Core
Date: 11/14/96
Recovery Length in Feet: 3.0
Mudline Elevation in Feet: −14.9 CRD

Northing: 690,425.95
Easting: 7,641,554.34
Drive Length in Feet: 5.0



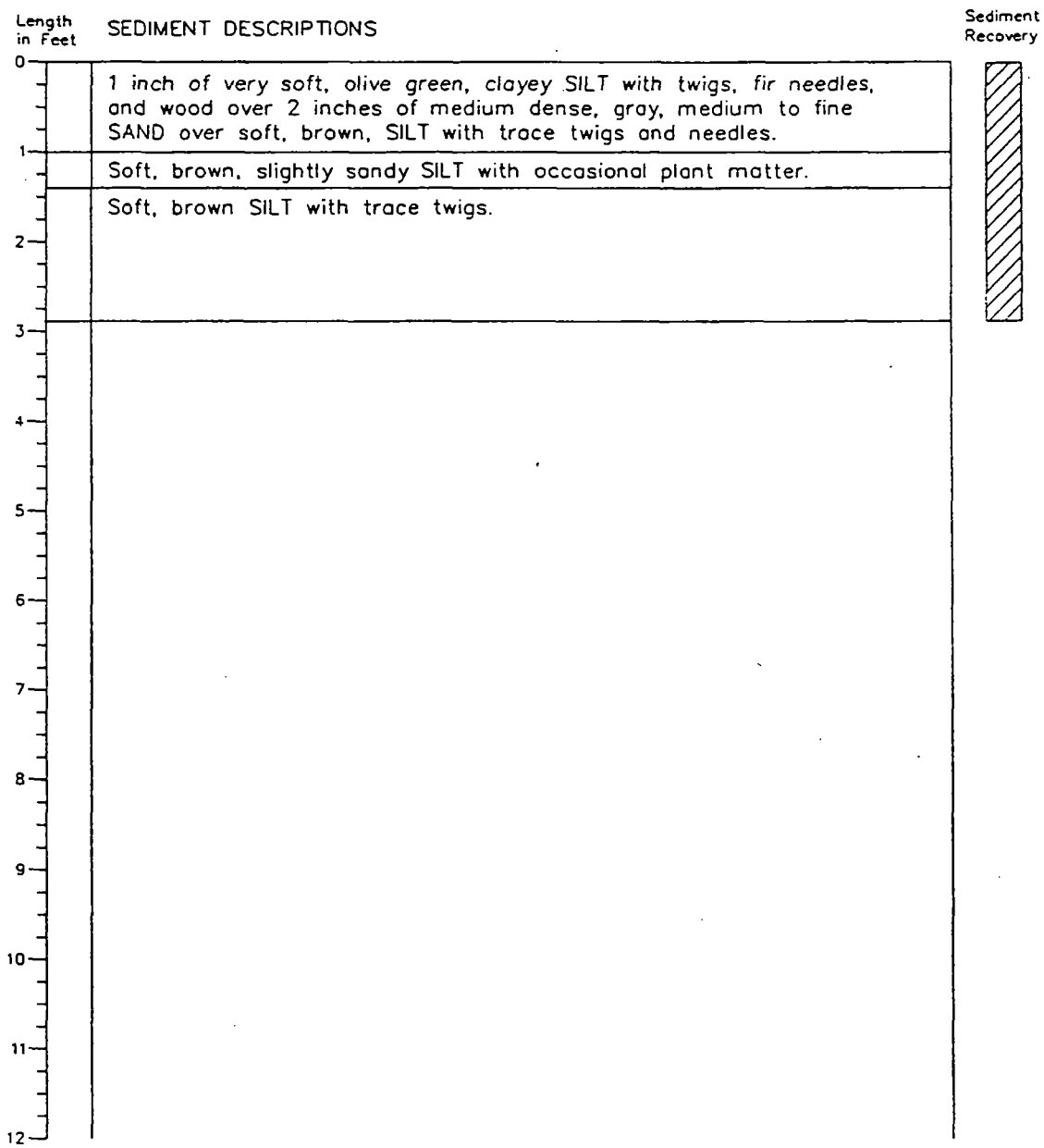
Note: Coordinates are NAD83 Oregon North Zone

HARTCROWSER
J-5589 11/96
Figure B-3

Sediment Core Log HC-GC-03

Type of Sample: Gravity Core
Date: 11/13/96
Recovery Length in Feet: 1.85
Mudline Elevation in Feet: −37.6 CRD

Northing: 694,317.98
Easting: 7,638,109.33
Drive Length in Feet: 2.0



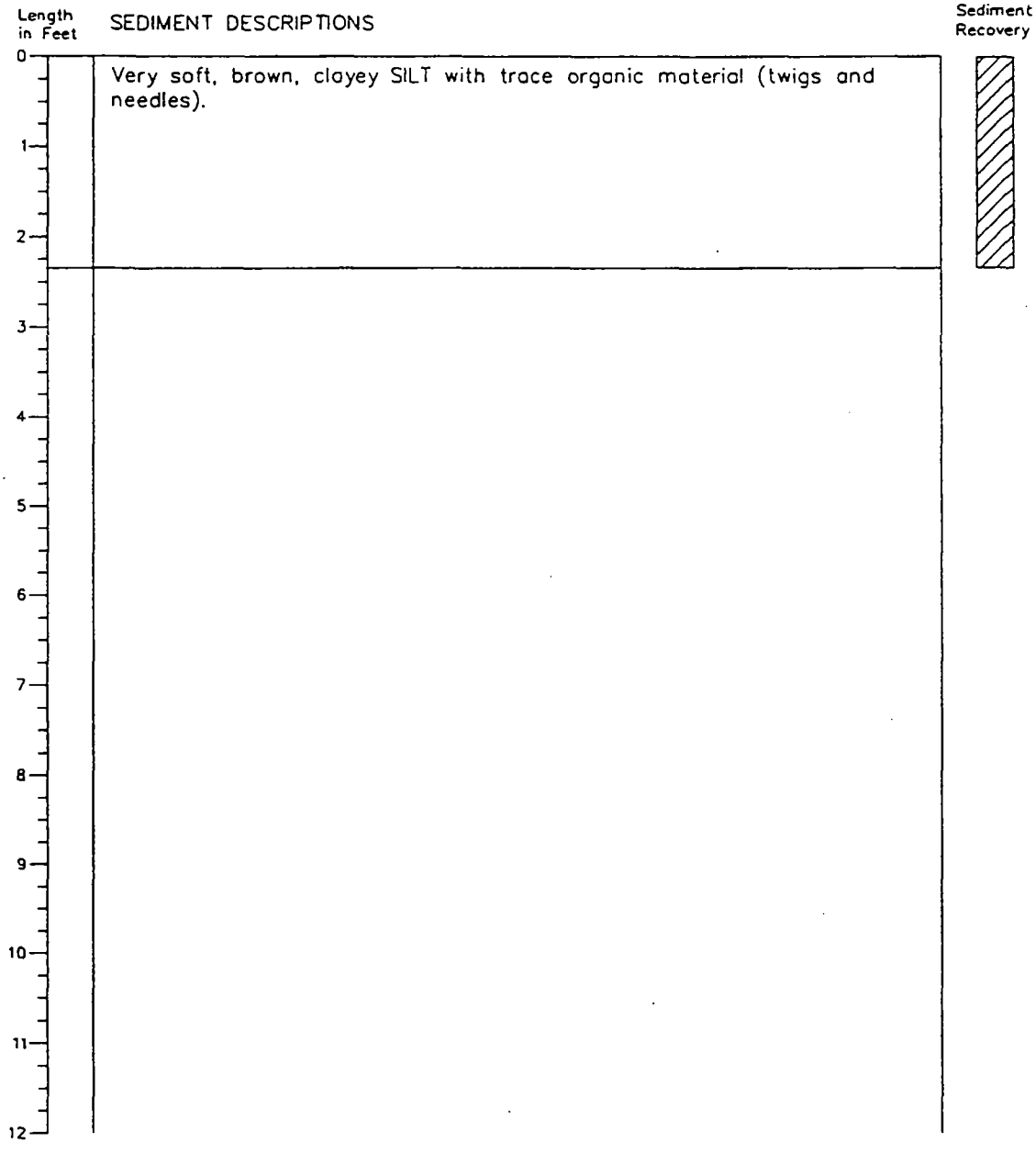
Note: Coordinates are NAD83 Oregon North Zone

HARTCROWSER
J-5589 11/96
Figure B-4

Sediment Core Log HC-GC-04

Type of Sample: Gravity Core
Date: 11/14/96
Recovery Length in Feet: 1.3
Mudline Elevation in Feet: −38.9 CRD

Northing: 694,034.55
Easting: 7,638,385.20
Drive Length in Feet: 2.0



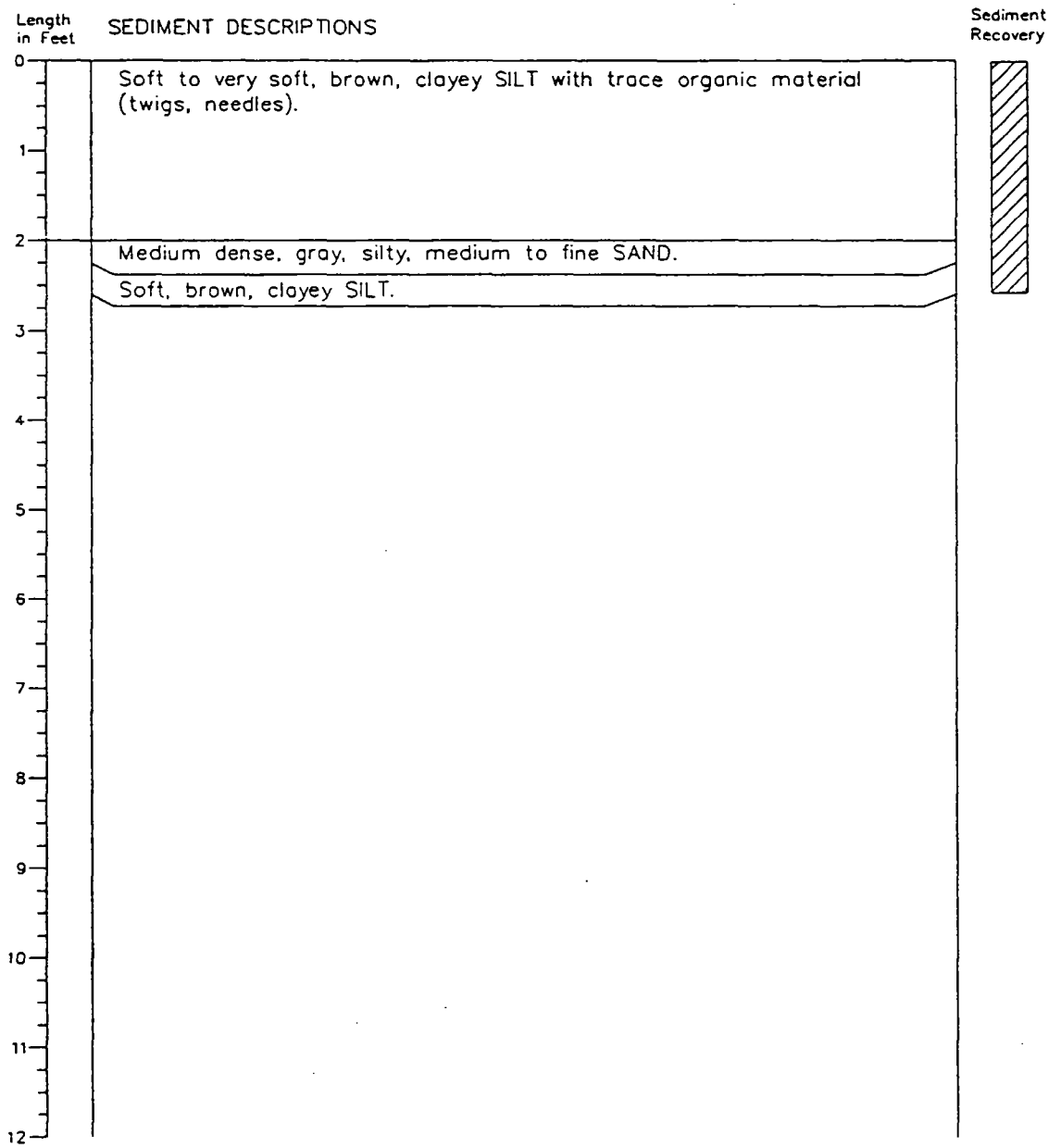
Note: Coordinates are NAD83 Oregon North Zone

HARTCROWSER
J-5589 11/96
Figure B-5

Sediment Core Log HC-GC-05

Type of Sample: Gravity Core
Date: 11/13/96
Recovery Length in Feet: 2.6
Mudline Elevation in Feet: −36.8 CRD

Northing: 693,783.25
Easting: 7,638,663.32
Drive Length in Feet: 4.0



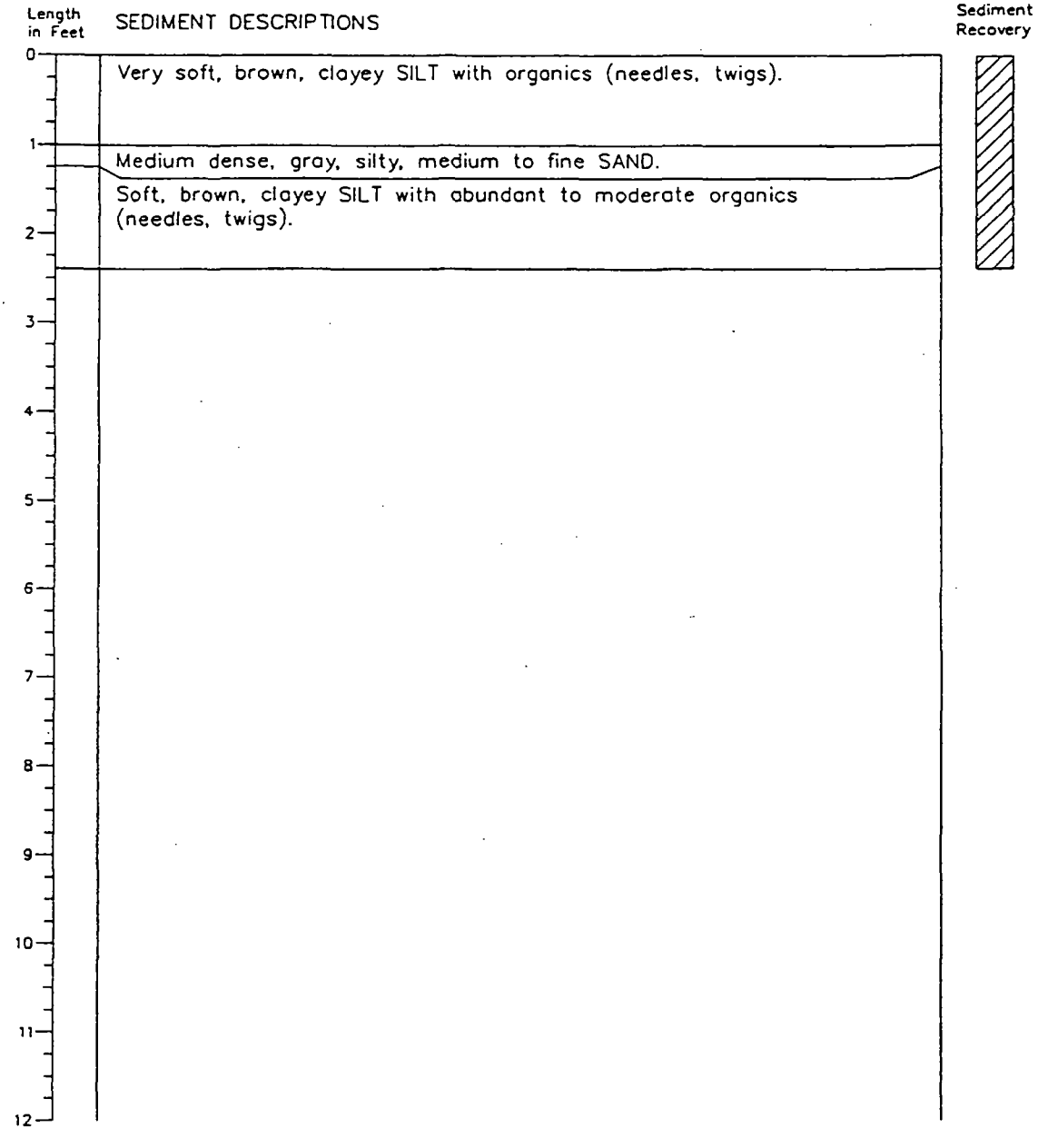
Note: Coordinates are NAD83 Oregon North Zone

HARTCROWSER
J-5589 11/96
Figure B-6

Sediment Core Log HC-GC-06

Type of Sample: Gravity Core
Date: 11/13/96
Recovery Length in Feet: 2.4
Mudline Elevation in Feet: −37 CRD

Northing: 693,495.10
Easting: 7,638,969.99
Drive Length in Feet: 4.3



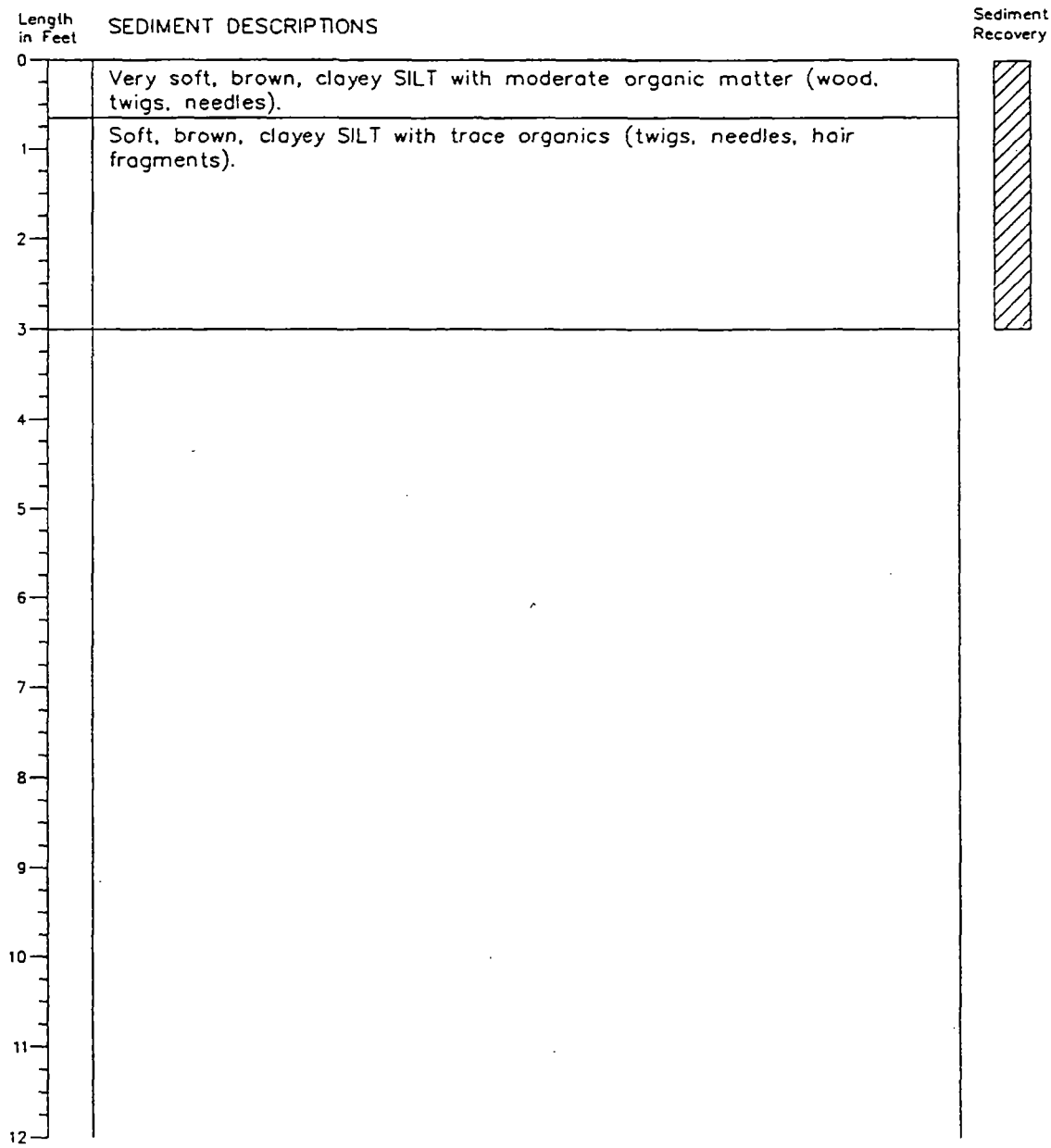
Note: Coordinates are NAD83 Oregon North Zone

HARTCROWSER
J-5589 11/96
Figure B-7

Sediment Core Log HC-GC-07

Type of Sample: Gravity Core
Date: 11/13/96
Recovery Length in Feet: 3.0
Mudline Elevation in Feet: −37.3 CRD

Northing: 693,220.98
Easting: 7,639,257.33
Drive Length in Feet: 4.2



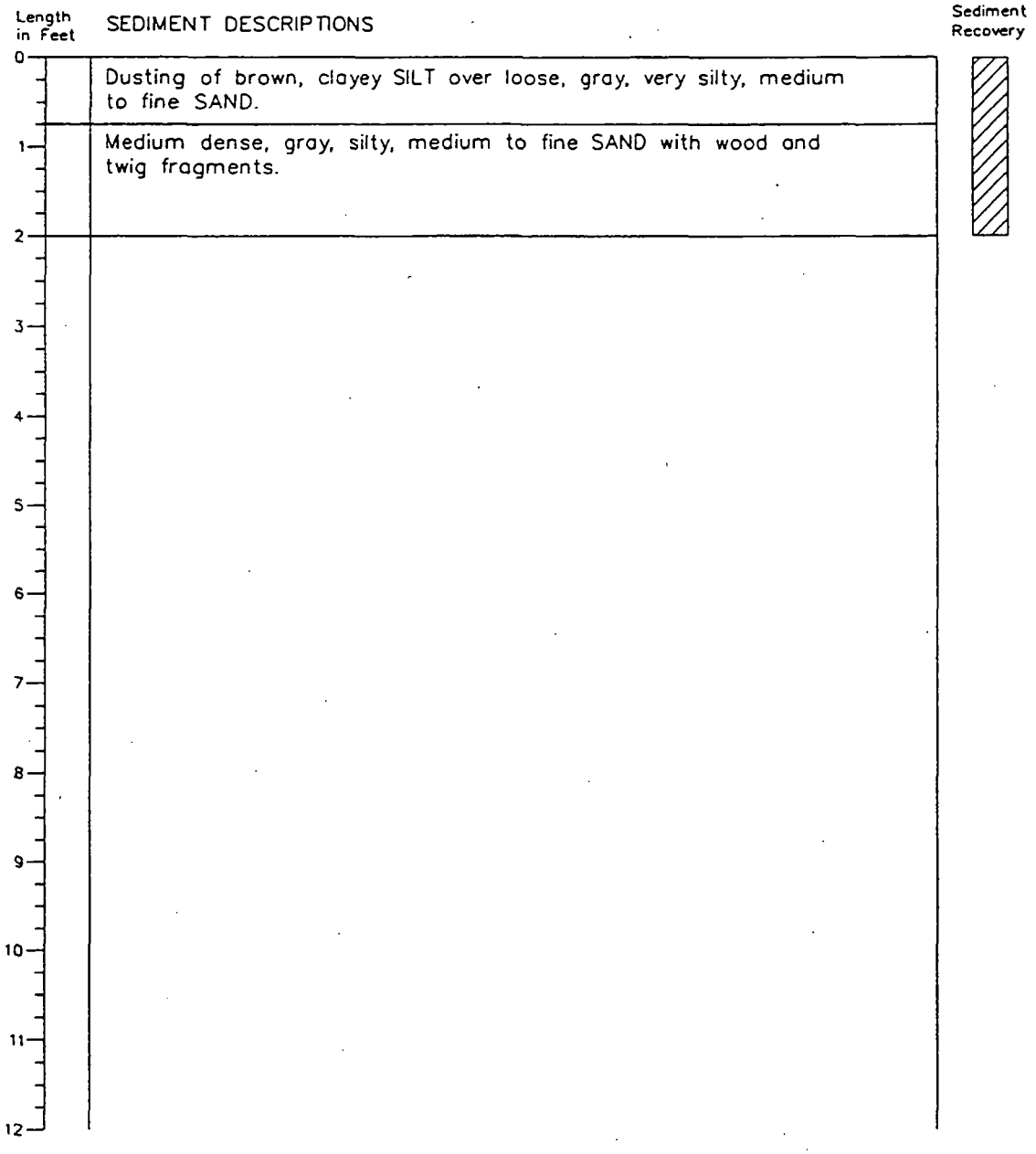
Note: Coordinates are NAD83 Oregon North Zone

HARTCROWSER
J-5589 11/96
Figure B-8

Sediment Core Log HC-GC-08

Type of Sample: Gravity Core
Date: 11/13/96
Recovery Length in Feet: 2.0
Mudline Elevation in Feet: −35.8 CRD

Northing: 692,958.61
Easting: 7,639,537.50
Drive Length in Feet: 4.0



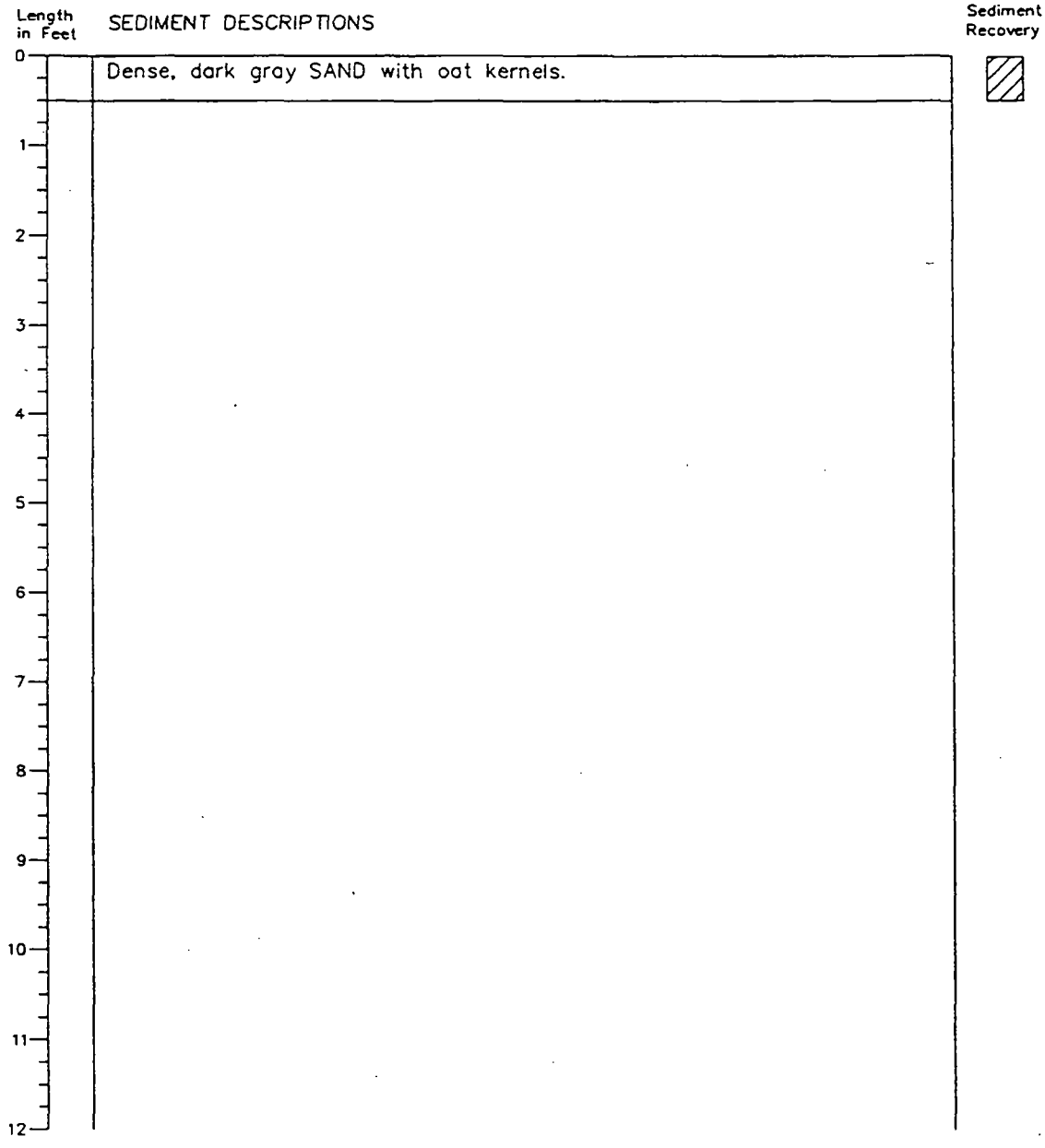
Note: Coordinates are NAD83 Oregon North Zone

HARTCROWSER
J-5589 11/96
Figure B-9

Sediment Core Log HC-SS-09

Type of Sample: Ponar Grab
Date: 11/14/96
Recovery Length in Feet: 6 inches
Mudline Elevation in Feet: −13.8 CRD

Northing: 728,384.44
Easting: 7,621,132.85
Drive Length in Feet: 6 inches



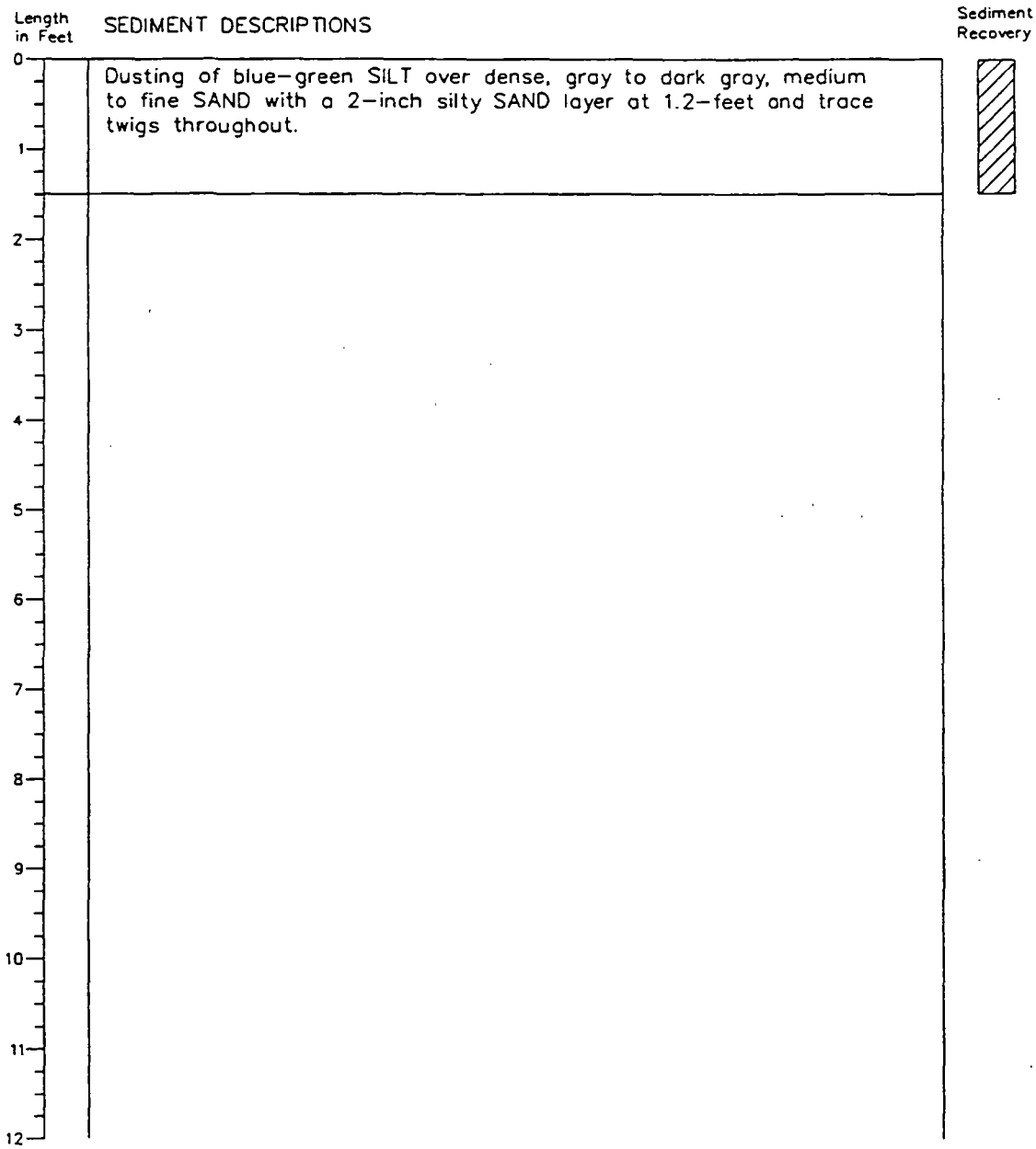
Note: Coordinates are NAD83 Oregon North Zone

HARTCROWSER
J-5589 11/96
Figure B-10

Sediment Core Log HC-GC-10

Type of Sample: Ponar Grab
Date: 11/13/96
Recovery Length in Feet: 1.5
Mudline Elevation in Feet: −13.0 CRD

Northing: 728,163.76
Easting: 7,620,829.27
Drive Length in Feet: 2.0



Note: Coordinates are NAD83 Oregon North Zone

HARTCROWSER
J-5589 11/96
Figure B-11

Attachment G
1999 Sediment Characterization Study
of Local Sponsors' Berths
Port of Portland Terminal 5

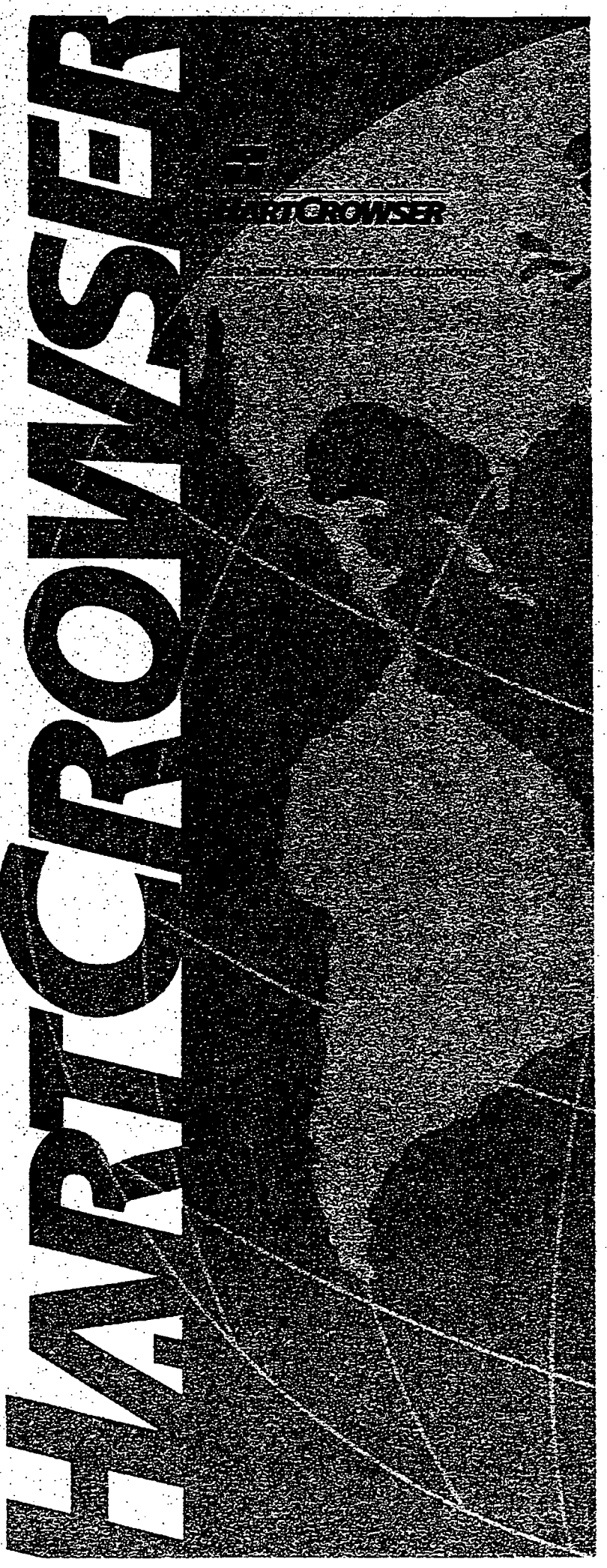
Volume I

Sediment Characterization Study of Local Sponsors' Berths; Columbia and Willamette River Navigation Channel Deepening; Longview and Kalama, Washington and Portland, Oregon

Prepared for
Port of Portland

Port Project No. 51773
Port Task No. 220

February 1, 1999
J-5760



CONTENTS

TABLES

FIGURES

APPENDICES

SEDIMENT CHARACTERIZATION STUDY OF LOCAL PORT SPONSORS' BERTHS; COLUMBIA AND WILLAMETTE RIVER NAVIGATION CHANNEL DEEPENING; LONGVIEW AND KALAMA, WASHINGTON AND PORTLAND, OREGON

1.0 INTRODUCTION

1.1 Project Description

This report presents the results of the sediment characterization study conducted at the Port of Longview and Port of Kalama, Washington, and the Port of Portland, Oregon (see Figure 1). This work was authorized by local port sponsors to support the proposed deepening of the Columbia and Willamette River Navigation Channels. Presently, at many of the grain and container handling facilities at the ports, the water depth at berths is less than the proposed navigational depth and will not accommodate deeper draft vessels once the federal navigational channel is deepened. The purpose of this report is to provide preliminary dredge prism characterization in support of the permitting process for the dredging of the Columbia River Navigation Channel. To meet this objective, two sediment cores were collected at each Dredge Material Management Unit (DMMU) identified in the project area. One composite sediment sample from each DMMU was analyzed for chemical, conventional, and grain size parameters as defined in the Draft Dredge Material Evaluation Framework for the Lower Columbia River Management Area (LCRMA) (Corps *et al.*, 1998).

The proposed Columbia River deepening project will deepen both the Columbia and Willamette River navigation channels. The proposed depth for Columbia River navigation channel is -43 feet (ft) Columbia River Datum (CRD) plus a 5 ft overdepth (-48 ft total depth); while the Willamette River navigation channel is proposed to be deepened to -43 ft CRD plus a 2 ft overdepth (-45 ft total depth).

Within the Portland Harbor, dredging is proposed along Berth 501, Berth 401, Terminal 6, and Irving Street Terminal to maintain future berthing elevations of -43 feet CRD. At the Port of Kalama, dredging is proposed along the Harvest States Grain Terminal and the Peavey Grain Terminal to maintain berth elevation of -43 feet CRD. At the Port of Longview, dredging is proposed along the Longview Grain Wharf to maintain berth elevation of -43 feet CRD. Deepening is not required at the Louis Dreyfuss Terminal in Portland and the United Grain Terminal in Vancouver based on recent hydrographic survey information.

An additional part of this study involved the collection of surface sediment grab samples at twelve deep water locations in the Willamette River (Figures 2 and 3). These samples were collected to supplement sediment sampling conducted in 1997 by the US Army Corps of Engineers (Corps) as part of the Willamette River channel deepening feasibility study. A sediment sample from each grab sample was analyzed for chemical, conventional, and grain size parameters as defined in LCRMA (Corps *et al.*, 1998).

1.2 Report Organization

The main body of this report discusses the results of the sediment characterization study and possible dredge disposal options based on comparison of the sediment characterization data with the LCRMA screening levels (LCRMA-SLs) (Corps *et al.*, 1998). Supporting discussions within the text include sediment sampling locations and any modifications to the Corps approved (pers. comm. Mark Siipola; September, 1998) Sampling and Analysis Plan (SAP) (Hart Crowser, September 3, 1998). The attached appendix presents supporting information including chemical data quality review (Appendix A). Additional procedural details are presented in the SAP (Hart Crowser, September, 1998) that guided this work. Copies of the laboratory certificates of analyses are provided in a separate volume (Appendix B).

2.0 SEDIMENT SAMPLING AND HANDLING

Except for modifications discussed in Section 2.2, all sediment sampling and handling activities were performed in accordance with the Corps-approved SAP (Hart Crowser, 1998). The sampling program was conducted in accordance with LCRMA guidelines to provide full characterization of dredged material.

2.1 Sampling Locations and Methods

Sediment samples were collected from each of the locations shown on Figures 1 through 3 on September 14 through 17, 1998. Tables 1 and 3 present the coordinates of the sampling locations, description of the sediment sample, the sediment elevation (in feet CRD) at the time of sampling, and the length of the collected sediment sample. Surface sediment samples were collected from each of the locations shown on Figures 2 and 3. Tables 2 and 4 present the coordinates of the sampling locations, description of the sediment sample, and the sediment elevation (in feet CRD) at the time of sampling.

2.2 Modifications to the Sampling and Analysis Plan

There were several modifications made to the SAP. Recent bathymetric information indicated that the water depths at the Louis Dreyfuss Terminal at the Port of Portland and the United Grain Terminal at the Port of Vancouver were sufficient to meet navigational requirements and do not require maintenance dredging. Therefore, these terminals were not sampled in this study. Several of the sediment cores (B501-02, B401-01, HS-01, PG-01, and LG-01) were collected in areas with a higher river bed elevation than was initially expected. Although the cores were collected to the maximum depth possible with the vibracore (6 foot cores), these cores are nevertheless a foot shy of the target maximum penetration depth (-45 feet). Therefore, archived sediment samples to characterize the sediment that would be exposed after dredging were not collected at these locations. The other sample locations (B501-01, B401-02, HS-02, PG-02, and LG-02), the riverbed elevation allowed the collection of an archived bottom sediment sample. Additionally, the proposed sediment sampling locations at the Irving Street Terminal were adjusted because a vessel at the berth restricted access to the original proposed locations. Sediment cores were collected near the bow and stern of the vessel (Table 3).

A final minor modification to the SAP was that all the sediment cores were processed in the field immediately upon retrieval. Therefore, there was no need to cap and store the sediment cores prior to processing on land.

2.3 Data Quality Review

A standard data quality review was performed by Hart Crowser on the analytical data package submitted by Columbia Analytical Services and is included as Appendix A of this report. Copies of the laboratory certificates of analyses are provided in a separate volume (Appendix B).

The data quality review concluded that the chemistry data are acceptable for evaluation of sediment disposal options. However, the sample quantitation limit (SQL) for various analytes exceeded the LCRMA-SLs for several of the submitted sediment samples (B401-C1, IS-C1, Grab 5, and Grab 6). If chemical SQLs are higher than the screening levels for a given matrix, a quantitative statement regarding the potential risk for those chemicals cannot be determined. The primary uncertainty is that a chemical may be present above a concentration believed to elicit adverse effects, but below the SQL that could be detected by the analytical method employed. However, for these sediment samples (with the exception of Grab 6), there were other detected chemicals that exceeded LCRMA SLs and in some cases maximum levels (MLs), and the determination of

disposal options under Tier II of the LCRMA did not have to be based on SQL exceedences.

3.0 COMPARISON OF CHEMISTRY RESULTS WITH LCRMA SCREENING LEVELS

Sediment chemistry results for the proposed dredge prisms at Berth 501, Terminal 6, Berth 401, and Irving Street Terminal at the Port of Portland; the Harvest States Grain Terminal and the Peavey Grain Terminal at the Port of Kalama; and the Longview Grain Terminal at the Port of Longview; as well as the sediment grab samples from the deep water locations in the Willamette River; were compared to sediment screening levels set forth in the LCRMA for evaluation of suitability for open-water disposal. Two LCRMA sediment quality criteria are provided for comparison with sediment analytical data. First, a lower Screening Level (SL) has been identified for each chemical which corresponds to concentrations below which sediments are acceptable for open water disposal. Second, a higher maximum level (ML) has been defined for each chemical which corresponds to concentrations above which sediments would be unacceptable for unconfined, open water disposal. As per LCRMA guidance, the SL for tributyltin (TBT) is based on a pore water concentration rather than a bulk sediment concentration. Sediment chemistry results are listed in Tables 5 through 9.

3.1 Berth 501

Two sediment cores were collected at this location and were composited into two depth integrated samples (Table 5). For DMMU 1/ B501 (composite sediment sample B501-C1), no metals, semivolatile organic compounds, PCBs, and butyltins were detected above their respective SLs. The only chemical detected above its SL in this DMMU was total DDT. The detected concentration of total DDT in this sample (14.9 µg/kg) slightly exceeded the LCRMA screening level for total DDT (6.9 µg/kg). Based on the exceedence of the LCRMA SL for total DDT, further evaluation of the dredge material from this DMMU is required to determine appropriate disposal options.

Sediments from DMMU 2/ B501 (composite sediment sample B501-C2) were determined to be suitable for unconfined open-water disposal as all detected compounds were at concentrations below corresponding LCRMA SLs.

3.2 Terminal 6

Two sediment cores were collected at this location and were composited into two depth integrated samples (Table 5). For DMMU 1/ T6 (composite sediment sample T6-C1), no semivolatile organic compounds, PCBs, and pesticides were detected above their respective SLs. The only chemical detected above its SL in this DMMU was TBT in pore water. The detected concentration of TBT in this sample (0.33 µg/L) exceeded the LCRMA screening level for TBT (0.15 µg/L). Based on the exceedence of the LCRMA SL for TBT, further evaluation of the dredge material from this DMMU is required to determine appropriate disposal options.

Sediments from DMMU 2/ T6 (composite sediment sample T6-C2) were determined to be suitable for unconfined open-water disposal as all detected compounds were at concentrations below corresponding LCRMA SLs.

3.3 Berth 401

Two sediment cores were collected at this location and were composited into two depth integrated samples (Table 6). For DMMU 1/ B401 (composite sediment sample B401-C1), no metals, volatile organic compounds, or PCBs were detected above their respective SLs. Two PAHs (Pyrene and Fluoranthene) slightly exceeded their respective SLs. The detected concentration of total DDT exceeded the ML. In addition, the sample quantitation limits (SQLs) for several phenols and semivolatile compounds exceeded their respective SLs making comparison with SLs uncertain. Based on the exceedences of various LCRMA SLs and the ML for total DDT, further evaluation of the dredge material from this DMMU is required to determine appropriate disposal options.

Sediments from DMMU 2/ B401 (composite sediment sample B401-C2) were determined to be suitable for unconfined open-water disposal. All measured compounds were at concentrations below the LCRMA SLs.

3.4 Irving Street Terminal

Two sediment cores were collected at this location and were composited into two depth integrated samples (Table 6). For DMMU 1/ IS (composite sediment sample IS-C1), six PAHs were detected above LCRMA MLs and seven PAHs were detected above the LCRMA SLs but below the corresponding MLs. The detected concentration of total PCBs also exceeded the LCRMA ML. In

addition, the sample quantitation limits (SQLs) for the pesticides total DDT and chlordane exceeded their respective SLs making comparison with SLs uncertain. Based on the exceedences of the LCRMA SLs and MLs at this DMMU, further evaluation of the dredge material is required to determine appropriate disposal options.

The detected compounds in sediments from DMMU 2/ IS (composite sediment sample IS-C2) were measured at concentrations below the corresponding LCRMA SLs except for total PCB. The detected concentration of total PCBs in sample IS-C2 (710 µg/kg) exceeded the LCRMA SL (130 µg/kg) for total PCB. Based on the exceedence of the LCRMA SL for PCBs, further evaluation of the dredge material is required to determine appropriate disposal options.

3.5 *Harvest States Grain Terminal*

Two sediment cores were collected at this location and were composited into two depth integrated samples (Table 7). Sediments from DMMU 1/ HS (composite sediment sample HS01-C1) were determined to be suitable for unconfined open-water disposal as all detected compounds were measured at concentrations below the corresponding LCRMA SLs.

All detected compounds in sediments from DMMU 2/ HS (composite sediment sample HS01-C2) were measured at concentrations below the corresponding LCRMA SLs. Sediments from DMMU 2/ HS were determined to be suitable for unconfined open-water disposal.

3.6 *Peavey Grain Terminal*

Two sediment cores were collected at this location and were composited into two depth integrated samples (Table 7). Sediments from DMMU 1/ PG (composite sediment sample PG01-C1) were determined to be suitable for unconfined open-water disposal as all detected compounds were measured at concentrations below the corresponding LCRMA SLs.

Sediments from DMMU 2/ PG (composite sediment sample PG01-C2) were determined to be suitable for unconfined open-water disposal as all detected compounds were measured at concentrations below the corresponding LCRMA SLs.

3.7 *Longview Grain Wharf*

Two sediment cores were collected at this location and were composited into two depth integrated samples (Table 8). Sediments from DMMU 1/ LG (composite sediment sample LG01-C1) were determined to be suitable for unconfined open-water disposal as all detected compounds were measured at concentrations below the corresponding LCRMA SLs.

Sediments from DMMU 2/ LG (composite sediment sample LG01-C2) were determined to be suitable for unconfined open-water disposal as all detected compounds were measured at concentrations below the corresponding LCRMA SLs.

3.8 *Sediment Grab Samples*

The analytical results from the surface sediment grab samples were compared to sediment screening levels set forth in the LCRMA (Table 9). As discussed previously, these samples were collected from deep water locations in the Willamette River to supplement the Corps 1997 channel deepening feasibility study. The results of the comparison of analytical data with LCRMA SLs are summarized below.

GRAB 1. All detected compounds in surface sediment sample Grab 1 were measured at concentrations below the corresponding LCRMA SLs.

GRAB 2. Detected compounds in sediments from surface sediment sample Grab 2 were measured at concentrations below the corresponding LCRMA SLs except for total DDT. The concentration of total DDT detected in Grab 2 (15.5 µg/kg) exceeded the LCRMA SL for total DDT (6.9 µg/kg).

GRAB 3. All detected compounds in surface sediment sample Grab 3 were measured at concentrations below the corresponding LCRMA SLs.

GRAB 4. Detected compounds in sediments from Grab 4 were measured at concentrations below the corresponding LCRMA SLs except for several PAHs and total DDT. The concentrations of three PAHs (fluoranthene, 2600 µg/kg; indeno(1,2,3-cd)pyrene, 980 µg/kg; and pyrene, 3000 µg/kg) in sample Grab 4 exceeded their corresponding LCRMA SLs (1700 µg/kg, 600 µg/kg, and 2600 µg/kg). The LCRMA SL for total DDT (6.9 µg/kg) was exceeded in sample Grab 4 (65.9 µg/kg).

GRAB 5. In this sample, the concentrations of fourteen PAHs were detected above the LCRMA MLs. The detected concentration of total DDT in this sample (25 µg/kg) exceeded the LCRMA SL (6.9 µg/kg). In addition, the SQLs for two PAHs, all of the phenols, all of the phthalates, and all of the semivolatile organic compounds exceeded LCRMA SLs and in some cases MLs making comparison with SLs and MLs uncertain.

GRAB 6. Detected compounds in sediments from Grab 6 were measured at concentrations below the corresponding LCRMA SLs. However, the SQLs for 2,4-dimethylphenol, hexachlorobenzene, hexachlorobutadiene, and N-nitrosodiphenylamine exceeded LCRMA SLs making comparison with SLs uncertain.

GRAB 7. All detected compounds in surface sediment sample Grab 7 were measured at concentrations below the corresponding LCRMA SLs.

GRAB 8. All detected compounds in surface sediment sample Grab 8 were measured at concentrations below the corresponding LCRMA SLs.

GRAB 9. All detected compounds in surface sediment sample Grab 9 were measured at concentrations below the corresponding LCRMA SLs.

GRAB 10. All detected compounds in surface sediment sample Grab 10 were measured at concentrations below the corresponding LCRMA SLs.

GRAB 11. All detected compounds in surface sediment sample Grab 11 were measured at concentrations below the corresponding LCRMA SLs.

GRAB 12. All detected compounds in surface sediment sample Grab 1 were measured at concentrations below the corresponding LCRMA SLs.

4.0 LIMITATIONS

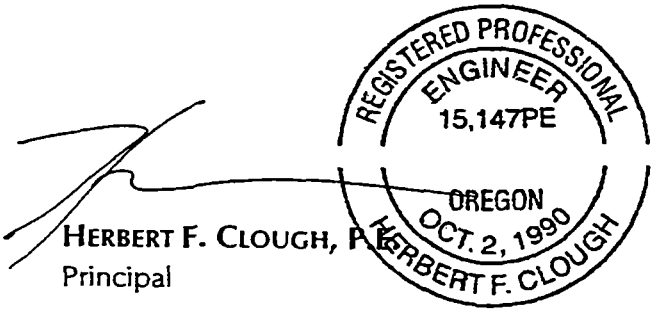
Work for this project was performed, and this report prepared, in accordance with generally accepted professional practices for the nature and conditions of the work completed in the same or similar localities, at the time the work was performed. It is intended for the exclusive use of Port of Portland for specific application to the referenced properties. This report is not meant to represent a legal opinion. No other warranty, express or implied, is made.

Any questions regarding our work and this report, the presentation of the information, and the interpretation of the data are welcome and should be referred to the undersigned.

Please feel free to contact us with any questions or comments.

Sincerely,

HART CROWSER, INC.



EXPIRES: DEC. 31, 1999

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5.0 REFERENCES

Corps et al., 1998. Dredged Material Evaluation Framework, Lower Columbia River Management Area. Draft April 1998.

Hart Crowser, 1998. Sampling and Analysis Plan, Sediment Testing for Full Characterization of Proposed Dredged Material, Longview, Kalama, and Vancouver, Washington, and Portland, Oregon. September 3, 1998.

Table 1 - Discrete Core Sample Description

Core Sample Identification	Sample Depth Interval in Feet [1]	Visual Sediment Description
Berth 501		
B501-01	0.0 to 6.0	Brown-gray, slightly silty, medium SAND with sheen at four feet
B501-02	0.0 to 5.0	Brown-gray, slightly silty, medium SAND
Terminal 6		
T6-01	0.0 to 3.5	Olive, slightly sandy SILT
	3.5 to 5.0	Olive-black, silty SAND with wood debris
T6-02	0.0 to 3.5	Olive, slightly sandy SILT
	3.5 to 6.0	Olive-black, silty SAND with wood debris
T6-03	0.0 to 3.5	Olive, slightly sandy SILT
	3.5 to 5.0	Olive-black, silty SAND with wood debris
Berth 401		
B401-01	0.0 to 1.0	Gray-brown, sandy SILT
	1.0 to 3.0	Gray-brown, sandy SILT with wood debris and silt laminates
	3.0 to 5.0	Gray, medium SAND
B401-02	0.0 to 1.0	Gray-brown, sandy SILT
	1.0 to 3.0	Gray-brown, sandy SILT with wood debris and silt laminates
	3.0 to 4.5	Gray, medium SAND
Irving Street		
IS-01	0.0 to 2.0	Olive, loose, SILT with wood fragments
	2.0 to 5.9	Black, medium coarse SAND
IS-02	0.0 to 2.0	Olive, loose, SILT with wood fragments and occasional sheen
	2.0 to 5.8	Black, medium coarse SAND
Harvest States		
HS-01	0 to 1.0	Olive, slightly silty SAND
	1.0 to 5.0	Gray, slightly silty SAND
HS-02	0 to 1.0	Olive, slightly silty SAND
	1.0 to 6.0	Gray, slightly silty SAND
Peavey Grain		
PG-01	0 to 2.0	Brown, slightly gravelly SAND
	2.0 to 5.0	Brown, gravelly SAND
PG-02	0 to 2.0	Brown, slightly gravelly SAND
	2.0 to 5.0	Brown, gravelly SAND
Longview Grain		
LG-01	0 to 3.0	Olive, silty SAND
	3.0 to 6	Dark gray, slightly silty SAND
LG-02	0 to 3.0	Olive, silty SAND
	3.0 to 6	Dark gray, slightly silty SAND

Notes:
1. Depth is not compaction corrected.

Table 2 - Surface Sediment Sample Description

Grab Sample Identification	Sample Depth Interval in Feet	Visual Sediment Description
Grab-01	0.67	Olive-gray, slightly sandy SILT, worm burrows
Grab-02	0.67	Olive-gray, slightly sandy SILT to 4"; Black med-fine SAND to 8", worm burrows
Grab-03	0.67	Olive-gray, very sandy SILT to 4"; Black med-fine slightly silty SAND to 8", worm burrows
Grab-04	0.67	Olive-brown SILT, slight sheen
Grab-05	0.67	Brown SILT to 2"; Brown-black coarse SAND to 8", slight sheen
Grab-06	0.67	Black, slightly silty SAND
Grab-07	0.67	Brown-olive, sandy SILT with wood debris and worm burrows
Grab-08	0.67	Gray-olive, loose SILT
Grab-09	0.67	Olive, loose SILT to 7", Black coarse SAND to 8"
Grab-10	0.67	Olive, loose SILT to 7"; Black coarse SAND to 8"
Grab-11	0.67	Olive, loose SILT with wood debris and worm burrows
Grab-12	0.67	Olive, loose SILT to 4"; Black med-coarse SAND to 8", worm burrows

Table 3 - Summary of Field Sampling Results for Core Samples

Sample Location	North Latitude	West Longitude	Mudline Elevation in Feet CRD	Core Penetration in Feet	Sample Recovery in Feet	Estimated Core Compaction in Percent	Core Penetration Elevation in Feet CRD	Notes
Berth 501								
B501-01	45° 38.531'	122° 46.359'	-40.0	6.0	6.0	0.0	-46.0	
B501-02	45° 38.486'	122° 46.437'	-39.0	6.0	5.0	16.7	-44.8	Full dredge depth not achieved.
Terminal 6								
T6-01	45° 38.528'	122° 45.010'	-40.0	6.0	5.0	16.7	-45.8	
T6-02	45° 38.449'	122° 44.926'	-40.0	6.0	6.0	0.0	-46.0	
T6-03	45° 38.314'	122° 44.727'	-40.0	5.0	5.0	0.0	-45.0	No archive sample collected from core.
Berth 401								
B401-01	45° 36.318'	122° 46.820'	-40.0	6.0	5.0	16.7	-45.8	
B401-02	45° 36.292'	122° 46.813'	-41.0	6.0	4.5	25.0	-46.6	
Irving Street								
IS-01	45° 32.091'	122° 40.478'	-40.5	6.0	5.9	1.7	-46.5	Vessel at berth. Sample collected near bow of vessel.
IS-02	45° 32.413'	122° 40.590'	-40.5	6.0	5.8	3.3	-46.5	Vessel at berth. Sample collected near stern of vessel.
Harvest States								
HS-01	45° 59.012'	122° 50.051'	-42	6.0	5.0	16.7	-47.8	Full dredge depth not achieved.
HS-02	45° 59.007'	122° 50.035'	-42	6.0	6.0	0.0	-48.0	
Peavey Grain								
PG-01	46° 01.560'	122° 52.063'	-41	5.0	5.0	0.0	-46.0	Full dredge depth not achieved.
PG-02	46° 01.569'	122° 52.047'	-41	5.0	5.0	0.0	-46.0	Full dredge depth not achieved.
Longview Grain								
LG-01	46° 06.271'	122° 57.121'	-39	6.0	6.0	0.0	-45.0	Full dredge depth not achieved.
LG-02	46° 06.275'	122° 57.110'	-40	6.0	6.0	0.0	-46.0	Full dredge depth not achieved.

Table 4 - Summary of Field Sampling Results for Surface Sediment Samples

Sample Location	North Latitude	West Longitude	Mudline Elevation in Feet CRD	Approximate River Mile
Grab-01	45° 35.311'	122° 46.800'	-70	4.5
Grab-02	45° 35.980'	122° 46.639'	-74	4.8
Grab-03	45° 35.665'	122° 46.378'	-78	5.1
Grab-04	45° 34.926'	122° 45.593'	-57	6.1
Grab-05	45° 34.955	122° 45.512'	-50	6.1
Grab-06	45° 34.886'	122° 45.333'	-48	6.3
Grab-07	45° 34.394'	122° 44.259'	-63	7.3
Grab-08	45° 34.019'	122° 43.821'	63	7.9
Grab-09	45° 33.225'	122° 42.203'	-73	9.4
Grab-10	45° 33.103'	122° 41.914'	-64.5	9.7
Grab-11	45° 32.639'	122° 41.403'	-76	10.5
Grab-12	45° 32.356'	122° 41.021'	-66	10.8

Table 5 - Draft Analytical Results for Sediment Samples; Berth 501 and Terminal 6

Sample ID			B501-C1	B501-C2	T6-C1	T6-C2
Lab ID			K9806351-009	K9806351-010	K9806423-001	K9806423-002
Sampling Date	LCRMA	LCRMA	9/14/98	9/14/98	9/16/98	9/16/98
Sampling Depth Interval	SL	ML	0 to 3 ft	3 to 5 ft	0 to 3 ft	3 to 5 ft
Conventionals						
Ammonia as Nitrogen			70.5	119	140	83.7
Carbon, Total Organic (TOC)			0.54	0.52	0.87	0.64
Solids, Total			62.1	69.6	58.9	63.6
Solids, Total Volatile			5.72	2.79	4.67	3.27
Sulfide, Total			41	45	13.1	100
Metals in mg/kg						
Antimony, Total	150	200	0.05	0.03	0.05	0.04 U
Arsenic, Total	57	700	2.6	1.2	2	2
Cadmium, Total	5.1	14	0.85	0.44	0.64	0.78
Chromium, Total			16.3	13.3	11.7	11.2
Copper, Total	390	1300	19.7	14.7	18.3	16.4
Lead, Total	450	1200	18.2	11.1	10	9.65
Mercury, Total	0.41	2.3	0.11	0.05	0.07	0.06
Nickel, Total	140	370	16.2	16.1	12.1	11.1
Silver, Total	6.1	8.4	0.18	0.16	0.13	0.14
Zinc, Total	410	3800	112	75.5	88	101
Organometallics in µg/L						
Tri-n-butyltin	0.15		0.03		0.33	
LPAHs in µg/kg						
Acenaphthene	500	2000	33	28	20 U	20 U
Acenaphthylene	560	1300	20 U	20 U	20 U	20 U
Anthracene	960	13000	35	20 U	20 U	31
Fluorene	540	3600	20 U	22	20 U	23
Naphthalene	2100	2400	50	20 U	20 U	20 U
Phenanthrene	1500	21000	250	140	56	120
Total LPAHs	5200	29000	368	190	56	174
HPAHs in µg/kg						
Benz(a)anthracene	1300	5100	130	34	52	56
Benzo(a)pyrene	1600	3600	180	38	35	40
Benzo(b)fluoranthene			120	32	42	49
Benzo(g,h,i)perylene	670	3200	100	23	20 U	28
Benzo(k)fluoranthene			100	26	36	47
Chrysene	1400	21000	160	42	55	86
Dibenz(a,h)anthracene	230	1900	20	20 U	20 U	20 U
Fluoranthene	1700	30000	300	93	120	170
Indeno(1,2,3-cd)pyrene	600	16000	130	30	23	38
Pyrene	2600	16000	390	120	110	140
Total Benzofluoranthenes	3200	9900	220	58	78	96
Total HPAHs	12000	69000	1630	438	473	654
Phenols in µg/kg						
2,4-Dimethylphenol	29	210	6 U	6 U	6 U	6 U
2-Methylphenol	63	77	6 U	6 U	6 U	6 U
4-Methylphenol	670	3600	77	20 U	20 U	20 U
Pentachlorophenol (PCP)	400	690	61 U	61 U	61 U	61 U
Phenol	420	1200	20 U	20 U	20 U	20 U
Phthalates in µg/kg						
Bis(2-ethylhexyl) Phthalate	8300		56	36	450	30
Butyl Benzyl Phthalate	970		20 U	20 U	190	20 U
Di-n-butyl Phthalate	5100		20 U	20 U	20 U	20 U

Table 5 - Draft Analytical Results for Sediment Samples; Berth 501 and Terminal 6

Sample ID			B501-C1	B501-C2	T6-C1	T6-C2
Lab ID			K9806351-009	K9806351-010	K9806423-001	K9806423-002
Sampling Date	LCRMA	LCRMA	9/14/98	9/14/98	9/16/98	9/16/98
Sampling Depth Interval	SL	ML	0 to 3 ft	3 to 5 ft	0 to 3 ft	3 to 5 ft
Di-n-octyl Phthalate	6200		20 U	20 U	20 U	20 U
Diethyl Phthalate	1200		20 U	20 U	20 U	20 U
Dimethyl Phthalate	1400		20 U	20 U	20 U	20 U
Semivolatiles in µg/kg						
Benzoic Acid	650	760	100 U	100 U	100 U	100 U
Benzyl Alcohol	57	870	6 U	6 U	6 U	6 U
Dibenzofuran	540	1700	20 U	20 U	20 U	20 U
Hexachlorobenzene	22	230	20 U	20 U	20 U	20 U
Hexachlorobutadiene	29	290	20 U	20 U	20 U	20 U
N-Nitrosodiphenylamine	28	130	12 U	12 U	12 U	12 U
Volatiles in µg/kg						
1,2-Dichlorobenzene	35	110	1 U	1 U	1 U	1 U
1,3-Dichlorobenzene	170		1 U	1 U	1 U	1 U
1,4-Dichlorobenzene	110	120	1 U	1 U	1 U	1 U
Pesticide/PCBs in µg/kg						
4,4'-DDD			9.9	3.9	2 U	2 U
4,4'-DDE			5	2.6	2	2
4,4'-DDT			6.7 U	6.7 U	2 U	2 U
Total DDT	6.9	69	14.9	6.5	2	2
Aldrin	10		1.7 U	1.7 U	2 U	2 U
Aroclor 1016			10 U	10 U	10 U	10 U
Aroclor 1221			10 U	10 U	10 U	10 U
Aroclor 1232			10 U	20 U	10 U	10 U
Aroclor 1242			22	10 U	10 U	10 U
Aroclor 1248			10 U	20 U	10 U	10 U
Aroclor 1254			20 U	15 U	10 U	10 U
Aroclor 1260			13	14	10 U	10 U
Total PCBs	130	3100	35	14	10 U	10 U
Chlordane	10					
Dieldrin	10		2.3 U	2.3 U	2 U	2 U
Endosulfan I					2 U	2 U
Endosulfan II					2 U	2 U
Endosulfan Sulfate					2 U	2 U
Endrin					2 U	2 U
Endrin Aldehyde					2 U	2 U
Endrin Ketone					2 U	2 U
Heptachlor	10		1.7 U	1.7 U	2 U	2 U
Heptachlor Epoxide					2 U	2 U
Methoxychlor					4 U	4 U
Toxaphene					30 U	30 U
alpha-BHC					2 U	2 U
alpha-Chlordane			1.7 U	1.7 U	2 U	2 U
beta-BHC					2 U	2 U
delta-BHC					2 U	2 U
gamma-BHC (Lindane)	10		1.7 U	1.7 U	2 U	2 U
gamma-Chlordane			1.7 U	1.7 U	2 U	2 U

Notes: Exceeds LCRMA SL

SQLs Exceeds LCRMA SL

Table 6 - Analytical Results for Sediment Samples; Berth 401 and Irving St.

Sample ID			B401-C1	B401-C2	IS-C1	IS-C2
Lab ID			K9806351-012	K9806351-013	K9806410-008	K9806410-009
Sampling Date	LCRMA	LCRMA	9/14/98	9/14/98	9/15/98	9/15/98
Sampling Depth Interval	SL	ML	0 to 3 ft	3 to 5 ft	0 to 3 ft	3 to 5 ft
Conventionals						
Ammonia as Nitrogen			209	154	65 UJ/J	100 UJ/J
Carbon, Total Organic (TOC)			1.63	0.53	1.03	0.91
Solids, Total			54	70.4		
Solids, Total Volatile			6.2	2.64		
Sulfide, Total			28	32	58	2
Metals in mg/kg						
Antimony, Total	150	200	0.02 U	0.03	0.19 UJ/J	0.26 UJ/J
Arsenic, Total	57	700	1.3	1	1.9	2.1
Cadmium, Total	5.1	14	0.33 J	0.14 J	0.26	0.26
Chromium, Total			16.1	10.9	19.1	47.8
Copper, Total	390	1300	21.8	14.4	26.6 UJ/J	25.6 UJ/J
Lead, Total	450	1200	12.4	9.8	29	367
Mercury, Total	0.41	2.3	0.21	0.08	0.07	0.08
Nickel, Total	140	370	16.1	15.3	20.1	25.5
Silver, Total	6.1	8.4	0.2	0.12	0.18	0.2
Zinc, Total	410	3800	87.6	53.4	90.1	115
Organometallics in µg/L						
Tri-n-butyltin	0.15		0.04		0.05	
LPAHs in µg/kg						
Acenaphthene	500	2000	210	38	34	20 U
Acenaphthylene	560	1300	200 U	20 U	240	20 U
Anthracene	960	13000	250	46	2200	20 U
Fluorene	540	3600	200 U	27	190	20 U
Naphthalene	2100	2400	290	95	190	20 U
Phenanthrene	1500	21000	1100	260	6800	45
Total LPAHs	5200	29000	1850	466	9654	45
HPAHs in µg/kg						
Benz(a)anthracene	1300	5100	690	170	6400	37
Benzo(a)pyrene	1600	3600	710	220	7300	61
Benzo(b)fluoranthene			460	140	2900	31
Benzo(g,h,i)perylene	670	3200	380	140	4400	270
Benzo(k)fluoranthene			450	130	5100	26
Chrysene	1400	21000	740	190	8100	40
Dibenz(a,h)anthracene	230	1900	200 U	20 U	660	53
Fluoranthene	1700	30000	2200	430	16000	98
Indeno(1,2,3-cd)pyrene	600	16000	410	180	4600	360
Pyrene	2600	16000	2700	540	19000	110
Total Benzofluoranthenes	3200	9900	910	270	8000	57
Total HPAHs	12000	69000	8740	2140	74460	1086
Phenols in µg/kg						
2,4-Dimethylphenol	29	210	60 U	6 U	6 U	6 U
2-Methylphenol	63	77	60 U	6 U	6 U	6 U
4-Methylphenol	670	3600	200 U	23	44	52
Pentachlorophenol (PCP)	400	690	610 U	61 U	61 U	61 U
Phenol	420	1200	200 U	20 U	20 U	20 U
Phthalates in µg/kg						
Bis(2-ethylhexyl) Phthalate	8300		200 U	20 U	220	160
Butyl Benzyl Phthalate	970		240	20 U	28	20 U
Di-n-butyl Phthalate	5100		200 U	20 U	20 U	20 U

Table 6 - Analytical Results for Sediment Samples; Berth 401 and Irving St.

Sample ID			B401-C1	B401-C2	IS-C1	IS-C2
Lab ID			K9806351-012	K9806351-013	K9806410-008	K9806410-009
Sampling Date	LCRMA	LCRMA	9/14/98	9/14/98	9/15/98	9/15/98
Sampling Depth Interval	SL	ML	0 to 3 ft	3 to 5 ft	0 to 3 ft	3 to 5 ft
Di-n-octyl Phthalate	6200		200 U	20 U	20 U	20 U
Diethyl Phthalate	1200		200 U	20 U	20 U	20 U
Dimethyl Phthalate	1400		200 U	20 U	20 U	20 U
Semivolatiles in µg/kg						
Benzoic Acid	650	760	1000 U	100 U	100 U	100 U
Benzyl Alcohol	57	870	60 U	6 U	6 U	6 U
Dibenzofuran	540	1700	200 U	20 U	27	20 U
Hexachlorobenzene	22	230	200 U	20 U	20 U	20 U
Hexachlorobutadiene	29	290	200 U	20 U	20 U	20 U
N-Nitrosodiphenylamine	28	130	120 U	12 U	12 U	12 U
Volatiles in µg/kg						
1,2-Dichlorobenzene	35	110	1 U	1 U	1 U	1 U
1,3-Dichlorobenzene	170		1 U	1 U	1 U	1 U
1,4-Dichlorobenzene	110	120	1 U	1 U	1 U	1 U
Pesticide/PCBs in µg/kg						
4,4'-DDD			14	5.1	20 U	2 U
4,4'-DDE			5.8	2.3 U	20 U	2 U
4,4'-DDT			460	6.7 U	20 U	2 U
Total DDT	6.9	69	479.8	5.1	20 U	2 U
Aldrin	10		1.7 U	1.7 U	2 U	2 U
Aroclor 1016			10 U	10 U	10 U	10 U
Aroclor 1221			10 U	10 U	10 U	10 U
Aroclor 1232			10 U	10 U	10 U	10 U
Aroclor 1242			10 U	10 U	10 U	10 U
Aroclor 1248			10 U	10 U	10 U	10 U
Aroclor 1254			25 U	10 U	10 U	10 U
Aroclor 1260			32	12	7100	710
Total PCBs	130	3100	32	12	7100	710
Chlordane	10					
Dieldrin	10		2.3 U	2.3 U	65 U	2 U
Endosulfan I					20 U	2 U
Endosulfan II					20 U	2 U
Endosulfan Sulfate					20 U	2 U
Endrin					20 U	2 U
Endrin Aldehyde					190 U	15 U
Endrin Ketone					20 U	2 U
Heptachlor	10		1.7 U	1.7 U	2 U	2 U
Heptachlor Epoxide					2 U	2 U
Methoxychlor					40 U	4 U
Toxaphene					300 U	300 U
alpha-BHC					2 U	2 U
alpha-Chlordane			1.7 U	1.7 U	20 U	2 U
beta-BHC					2 U	2 U
delta-BHC					2 U	2 U
gamma-BHC (Lindane)	10		1.7 U	1.7 U	2 U	2 U
gamma-Chlordane			1.7 U	1.7 U	20 U	3 U

Notes: Exceeds LCRMA SL; SQLs Exceeds LCRMA SL; Exceeds LCRMA ML

Table 7 - Analytical Results for Sediment Samples; Harvest States and Peavey Grain

Sample ID			HS-01-C1	HS01-C2	PG01-C1	PG01-C2
Lab ID			K9806462-001	K9806462-002	K9806462-004	K9806462-005
Sampling Date	LCRMA	LCRMA	9/17/98	9/17/98	9/17/98	9/17/98
Sampling Depth Interval	SL	ML	0 to 3 ft	3 to 5 ft	0 to 3 ft	3 to 5 ft
Conventionals						
Ammonia as Nitrogen			7.6	20.8	0.4	2.8
Carbon, Total Organic (TOC)			0.05	0.07	0.1	0.05 U
Solids, Total			80.5	77	78.5	82.8
Solids, Total Volatile			1.01	1.11	1.28	1.07
Sulfide, Total			0.7 U	0.7 U	0.7 U	0.7 U
Metals in mg/kg						
Antimony, Total	150	200	0.04 UJ/J	0.04 UJ/J	0.04 UJ/J	0.04 UJ/J
Arsenic, Total	57	700	0.6 J	0.5 J	0.4 J	0.4 J
Cadmium, Total	5.1	14	0.18	0.1	0.08	0.03 J
Chromium, Total			4.7	3.6	3.6	1.6
Copper, Total	390	1300	7.5	11.3	8.4	9.2
Lead, Total	450	1200	2.26	1.14	1.83	1.01
Mercury, Total	0.41	2.3	0.02 U	0.02 U	0.02 U	0.02 U
Nickel, Total	140	370	6.5	5	6.2	4.7
Silver, Total	6.1	8.4	0.05	0.01 J	0.03 J	0.02 J
Zinc, Total	410	3800	27	16	20	14
Organometallics in µg/L						
Tri-n-butyltin	0.15		0.02 UJ/J		0.02 UJ/J	
LPAHs in µg/kg						
Acenaphthene	500	2000	20 U	68	20 U	20 U
Acenaphthylene	560	1300	20 U	20 U	20 U	20 U
Anthracene	960	13000	20 U	20 U	20 U	20 U
Fluorene	540	3600	20 U	20 U	20 U	20 U
Naphthalene	2100	2400	20 U	20 U	20 U	20 U
Phenanthrene	1500	21000	20 U	20 U	20 U	20 U
Total LPAHs	5200	29000	20 U	68	20 U	20 U
HPAHs in µg/kg						
Benz(a)anthracene	1300	5100	20 U	20 U	20 U	20 U
Benzo(a)pyrene	1600	3600	20 U	20 U	20 U	20 U
Benzo(b)fluoranthene			20 U	20 U	20 U	20 U
Benzo(g,h,i)perylene	670	3200	20 U	20 U	20 U	20 U
Benzo(k)fluoranthene			20 U	20 U	20 U	20 U
Chrysene	1400	21000	20 U	20 U	20 U	20 U
Dibenz(a,h)anthracene	230	1900	20 U	20 U	20 U	20 U
Fluoranthene	1700	30000	20 U	20 U	20 U	20 U
Indeno(1,2,3-cd)pyrene	600	16000	20 U	20 U	20 U	20 U
Pyrene	2600	16000	20 U	20 U	20 U	20 U
Total Benzofluoranthenes	3200	9900	20 U	20 U	20 U	20 U
Total HPAHs	12000	69000	20 U	20 U	20 U	20 U
Phenols in µg/kg						
2,4-Dimethylphenol	29	210	6 U	6 U	6 U	6 U
2-Methylphenol	63	77	6 U	6 U	6 U	6 U
4-Methylphenol	670	3600	20 U	20 U	20 U	20 U
Pentachlorophenol (PCP)	400	690	61 U	61 U	61 U	61 U
Phenol	420	1200	20 U	20 U	20 U	20 U
Phthalates in µg/kg						
Bis(2-ethylhexyl) Phthalate	8300		26	20 U	20 U	20 U
Butyl Benzyl Phthalate	970		20 U	20 U	20 U	20 U
Di-n-butyl Phthalate	5100		20 U	20 U	20 U	20 U

Table 7 - Analytical Results for Sediment Samples; Harvest States and Peavey Grain

Sample ID Lab ID Sampling Date Sampling Depth Interval	LCRMA SL	LCRMA ML	HS-01-C1 K9806462-001 9/17/98 0 to 3 ft	HS01-C2 K9806462-002 9/17/98 3 to 5 ft	PG01-C1 K9806462-004 9/17/98 0 to 3 ft	PG01-C2 K9806462-005 9/17/98 3 to 5 ft
Di-n-octyl Phthalate	6200		20 U	20 U	20 U	20 U
Diethyl Phthalate	1200		20 U	20 U	20 U	20 U
Dimethyl Phthalate	1400		20 U	20 U	20 U	20 U
Semivolatiles in µg/kg						
Benzoic Acid	650	760	100 U	100 U	100 U	100 U
Benzyl Alcohol	57	870	6 U	6 U	6 U	6 U
Dibenzofuran	540	1700	20 U	20 U	20 U	20 U
Hexachlorobenzene	22	230	20 U	20 U	20 U	20 U
Hexachlorobutadiene	29	290	20 U	20 U	20 U	20 U
N-Nitrosodiphenylamine	28	130	12 U	12 U	12 U	12 U
Volatiles in µg/kg						
1,2-Dichlorobenzene	35	110	1 U	1 U	1 U	1 U
1,3-Dichlorobenzene	170		1 U	1 U	1 U	1 U
1,4-Dichlorobenzene	110	120	1 U	1 U	1 U	1 U
Pesticide/PCBs in µg/kg						
4,4'-DDD			3.3 U	3.3 U	3.3 U	3.3 U
4,4'-DDE			2.3 U	2.3 U	2.3 U	2.3 U
4,4'-DDT			6.7 U	6.7 U	6.7 U	6.7 U
Total DDT	6.9	69	6.7 U	6.7 U	6.7 U	6.7 U
Aldrin	10		1.7 U	1.7 U	1.7 U	1.7 U
Aroclor 1016			10 U	10 U	10 U	10 U
Aroclor 1221			10 U	10 U	10 U	10 U
Aroclor 1232			10 U	10 U	10 U	10 U
Aroclor 1242			10 U	10 U	10 U	10 U
Aroclor 1248			10 U	10 U	10 U	10 U
Aroclor 1254			10 U	10 U	10 U	10 U
Aroclor 1260			10 U	10 U	10 U	10 U
Total PCBs	130	3100	10 U	10 U	10 U	10 U
Chlordane	10		2 U	2 U	2 U	2 U
Dieldrin	10		2.3 U	2.3 U	2.3 U	2.3 U
Endosulfan I						
Endosulfan II						
Endosulfan Sulfate						
Endrin						
Endrin Aldehyde						
Endrin Ketone						
Heptachlor	10		1.7 U	1.7 U	1.7 U	1.7 U
Heptachlor Epoxide						
Methoxychlor						
Toxaphene						
alpha-BHC						
alpha-Chlordane						
beta-BHC						
delta-BHC						
gamma-BHC (Lindane)	10		1.7 U	1.7 U	1.7 U	1.7 U
gamma-Chlordane						

Notes: Exceeds LCRMA SL

SQLs Exceeds LCRMA SL

Table 8 - Analytical Results for Sediment Samples; Longview Grain

Sample ID			LG01-C1	LG01-C2
Lab ID			K9806462-007	K9806462-008
Sampling Date	LCRMA	LCRMA	9/15/98	9/15/98
Sampling Depth Interval	SL	ML	0 to 3 ft	3 to 5 ft
Conventionals				
Ammonia as Nitrogen			24.1	2.6
Carbon, Total Organic (TOC)			0.3	0.05 U
Solids, Total			68	75.3
Solids, Total Volatile			1.58	0.64
Sulfide, Total			5.93	0.71
Metals in mg/kg				
Antimony, Total	150	200	0.04 UJ/J	0.04 UJ/J
Arsenic, Total	57	700	0.5 J	0.2 J
Cadmium, Total	5.1	14	0.1	0.07
Chromium, Total			3.8	2.1
Copper, Total	390	1300	14.9	9.4
Lead, Total	450	1200	1.93	0.84
Mercury, Total	0.41	2.3	0.02 U	0.02 U
Nickel, Total	140	370	5.7	4.8
Silver, Total	6.1	8.4	0.04	0.02 J
Zinc, Total	410	3800	18	10
Organometallics in µg/L				
Tri-n-butyltin	0.15		0.02 UJ/J	
LPAHs in µg/kg				
Acenaphthene	500	2000	20 U	20 U
Acenaphthylene	560	1300	20 U	20 U
Anthracene	960	13000	20 U	20 U
Fluorene	540	3600	20 U	20 U
Naphthalene	2100	2400	20 U	20 U
Phenanthrene	1500	21000	20 U	20 U
Total LPAHs	5200	29000	20 U	20 U
HPAHs in µg/kg				
Benz(a)anthracene	1300	5100	20 U	20 U
Benzo(a)pyrene	1600	3600	20 U	20 U
Benzo(b)fluoranthene			20 U	20 U
Benzo(g,h,i)perylene	670	3200	20 U	20 U
Benzo(k)fluoranthene			20 U	20 U
Chrysene	1400	21000	20 U	20 U
Dibenz(a,h)anthracene	230	1900	20 U	20 U
Fluoranthene	1700	30000	36	20 U
Indeno(1,2,3-cd)pyrene	600	16000	20 U	20 U
Pyrene	2600	16000	24	20 U
Total Benzofluoranthenes	3200	9900	20 U	20 U
Total HPAHs	12000	69000	60	20 U
Phenols in µg/kg				
2,4-Dimethylphenol	29	210	6 U	6 U
2-Methylphenol	63	77	6 U	6 U
4-Methylphenol	670	3600	20 U	20 U
Pentachlorophenol (PCP)	400	690	61 U	61 U
Phenol	420	1200	20 U	20 U
Phthalates in µg/kg				
Bis(2-ethylhexyl) Phthalate	8300		20 U	20 U
Butyl Benzyl Phthalate	970		20 U	20 U
Di-n-butyl Phthalate	5100		20 U	20 U

Table 8 - Analytical Results for Sediment Samples; Longview Grain

Sample ID Lab ID Sampling Date Sampling Depth Interval	LCRMA SL	LCRMA ML	LG01-C1 K9806462-007 9/15/98 0 to 3 ft	LG01-C2 K9806462-008 9/15/98 3 to 5 ft
Di-n-octyl Phthalate	6200		20 U	20 U
Diethyl Phthalate	1200		20 U	20 U
Dimethyl Phthalate	1400		20 U	20 U
Semivolatiles in µg/kg				
Benzoic Acid	650	760	100 U	100 U
Benzyl Alcohol	57	870	6 U	6 U
Dibenzofuran	540	1700	20 U	20 U
Hexachlorobenzene	22	230	20 U	20 U
Hexachlorobutadiene	29	290	20 U	20 U
N-Nitrosodiphenylamine	28	130	12 U	12 U
Volatiles in µg/kg				
1,2-Dichlorobenzene	35	110	1 U	1 U
1,3-Dichlorobenzene	170		1 U	1 U
1,4-Dichlorobenzene	110	120	1 U	1 U
Pesticide/PCBs in µg/kg				
4,4'-DDD			3.3 U	3.3 U
4,4'-DDE			2.3 U	2.3 U
4,4'-DDT			6.7 U	6.7 U
Total DDT	6.9	69	6.7 U	6.7 U
Aldrin	10		1.7 U	1.7 U
Aroclor 1016			10 U	10 U
Aroclor 1221			10 U	10 U
Aroclor 1232			10 U	10 U
Aroclor 1242			10 U	10 U
Aroclor 1248			10 U	10 U
Aroclor 1254			10 U	10 U
Aroclor 1260			10 U	10 U
Total PCBs	130	3100	10 U	10 U
Chlordane	10		2 U	2 U
Dieldrin	10		2.3 U	2.3 U
Endosulfan I				
Endosulfan II				
Endosulfan Sulfate				
Endrin				
Endrin Aldehyde				
Endrin Ketone				
Heptachlor	10		1.7 U	1.7 U
Heptachlor Epoxide				
Methoxychlor				
Toxaphene				
alpha-BHC				
alpha-Chlordane				
beta-BHC				
delta-BHC				
gamma-BHC (Lindane)	10		1.7 U	1.7 U
gamma-Chlordane				

Notes: Exceeds LCRMA SL

SQLs Exceeds LCRMA SL

Table 9 - Analytical Results for Sediment Samples; Willamette River Surface Sediment Samples

Sample ID Lab ID Sampling Date Sampling Depth Interval	LCRMA SL	LCRMA ML	Grab 1 K9806351-001 9/14/98 0 to 10 cm	Grab 2 K9806351-002 9/14/98 0 to 10 cm	Grab 3 K9806351-003 9/14/98 0 to 10 cm	Grab 4 K9806351-004 9/14/98 0 to 10 cm
Conventionals						
Ammonia as Nitrogen			161	83.7	29.5	128
Carbon, Total Organic (TOC)			1.98	1.38	1.03	2.27
Solids, Total			44	50.7	57.5	38.6
Solids, Total Volatile			8.5	8.31	4.97	9.01
Sulfide, Total			56	100	52	7
Metals in mg/kg						
Antimony, Total	150	200	0.02 U	0.02	0.02 U	0.02
Arsenic, Total	57	700	1.8	1.8	1.8	1.8
Cadmium, Total	5.1	14	0.27 J	0.22 J	0.16 J	0.2 J
Chromium, Total			19.5	17.7	14.3	21.2
Copper, Total	390	1300	26.2	22.7	18.3	26.2
Lead, Total	450	1200	17.7	13.9	9.58	17.7
Mercury, Total	0.41	2.3	0.07	0.05	0.03 J	0.07
Nickel, Total	140	370	15.8	16.1	15.2	16.3
Silver, Total	6.1	8.4	0.2	0.2	0.16	0.24
Zinc, Total	410	3800	70.1	66	52.3	67.9
Organometallics in µg/L						
Tri-n-butyltin	0.15		0.05	0.05	0.02 U	0.02 U
LPAHs in µg/kg						
Acenaphthene	500	2000	20 U	26	20 U	250
Acenaphthylene	560	1300	20 U	21	20 U	90
Anthracene	960	13000	32	33	25	310
Fluorene	540	3600	20 U	20 U	20	180
Naphthalene	2100	2400	20 U	20 U	20 U	160
Phenanthrene	1500	21000	130	100	88	1200
Total LPAHs	5200	29000	162	180	133	2190
HPAHs in µg/kg						
Benz(a)anthracene	1300	5100	180	210	81	1200
Benzo(a)pyrene	1600	3600	230	290	110	1500
Benzo(b)fluoranthene			210	220	89	1100
Benzo(g,h,i)perylene	670	3200	150	150	72	620
Benzo(k)fluoranthene			150	160	69	920
Chrysene	1400	21000	190	210	94	1200
Dibenz(a,h)anthracene	230	1900	51	40	20 U	140
Fluoranthene	1700	30000	350	380	200	2600
Indeno(1,2,3-cd)pyrene	600	16000	220	220	100	980
Pyrene	2600	16000	330	430	250	3000
Total Benzofluoranthenes	3200	9900	360	380	158	2020
Total HPAHs	12000	69000	2061	2310	1065	13260
Phenols in µg/kg						
2,4-Dimethylphenol	29	210	6 U	6 U	6 U	6 U
2-Methylphenol	63	77	6 U	6 U	6 U	6 U
4-Methylphenol	670	3600	20 U	20 U	20 U	20 U
Pentachlorophenol (PCP)	400	690	61 U	61 U	61 U	61 U
Phenol	420	1200	20 U	20 U	20 U	20 U
Phthalates in µg/kg						
Bis(2-ethylhexyl) Phthalate	8300		400	280	200	470
Butyl Benzyl Phthalate	970		21	25	26	55
Di-n-butyl Phthalate	5100		20 U	20 U	20 U	20 U

Table 9 - Analytical Results for Sediment Samples; Willamette River Surface Sediment Samples

Sample ID Lab ID Sampling Date Sampling Depth Interval	LCRMA SL	LCRMA ML	Grab 1 K9806351-001 9/14/98 0 to 10 cm	Grab 2 K9806351-002 9/14/98 0 to 10 cm	Grab 3 K9806351-003 9/14/98 0 to 10 cm	Grab 4 K9806351-004 9/14/98 0 to 10 cm
Di-n-octyl Phthalate	6200		20 U	20 U	20 U	20 U
Diethyl Phthalate	1200		20 U	20 U	20 U	20 U
Dimethyl Phthalate	1400		20 U	20 U	20 U	20 U
Semivolatiles in µg/kg						
Benzoic Acid	650	760	100 U	100 U	100 U	100
Benzyl Alcohol	57	870	12	6 U	6 U	15
Dibenzofuran	540	1700	20 U	20 U	20 U	45
Hexachlorobenzene	22	230	20 U	20 U	20 U	20 U
Hexachlorobutadiene	29	290	20 U	20 U	20 U	20 U
N-Nitrosodiphenylamine	28	130	12 U	12 U	12 U	12 U
Volatiles in µg/kg						
1,2-Dichlorobenzene	35	110	1 U	1 U	1 U	1 U
1,3-Dichlorobenzene	170		1 U	1 U	1 U	1 U
1,4-Dichlorobenzene	110	120	1 U	1 U	1 U	1 U
Pesticide/PCBs in µg/kg						
4,4'-DDD			3.3 U	3.3 U	3.3 U	11
4,4'-DDE			3.5	2.5	2.3 U	5.9
4,4'-DDT			6.7 U	13	6.7 U	49
Total DDT	6.9	69	3.5	15.5	6.7 U	65.9
Aldrin	10		1.7 U	1.7 U	1.7 U	2.2
Aroclor 1016			10 U	10 U	10 U	10 U
Aroclor 1221			10 U	10 U	10 U	10 U
Aroclor 1232			10 U	10 U	10 U	10 U
Aroclor 1242			10 U	10 U	10 U	10 U
Aroclor 1248			10 U	10 U	10 U	10 U
Aroclor 1254			10 U	10 U	10 U	15 U
Aroclor 1260			13	10 U	10 U	13
Total PCBs	130	3100	13	10 U	10 U	13
Chlordane	10					
Dieldrin	10		2.3 U	2.3 U	2.3 U	2.3 U
Endosulfan I						
Endosulfan II						
Endosulfan Sulfate						
Endrin						
Endrin Aldehyde						
Endrin Ketone						
Heptachlor	10		1.7 U	1.7 U	1.7 U	1.7 U
Heptachlor Epoxide						
Methoxychlor						
Toxaphene						
alpha-BHC						
alpha-Chlordane			1.7 U	1.7 U	1.7 U	1.7 U
beta-BHC						
delta-BHC						
gamma-BHC (Lindane)	10		1.7 U	1.7 U	1.7 U	1.7 U
gamma-Chlordane			1.7 U	1.7 U	1.7 U	1.7 U

Notes: Exceeds LCRMA SL

SQLs Exceeds LCRMA SL

Table 9 - Analytical Results for Sediment Samples; Willamette River Surface Sediment Samples

Sample ID Lab ID Sampling Date Sampling Depth Interval	LCRMA SL	LCRMA ML	Grab 5 K9806351-005 9/14/98 0 to 10 cm	Grab 6 K9806351-006 9/14/98 0 to 10 cm	Grab 7 K9806351-007 9/14/98 0 to 10 cm	Grab 8 K9806351-008 9/14/98 0 to 10 cm
Conventionals						
Ammonia as Nitrogen			14.2	15.3	72.4	122
Carbon, Total Organic (TOC)			0.81	0.65	2.06	1.41
Solids, Total			71.7	76.6	53.3	40
Solids, Total Volatile			2.51	3.34	7.32	7.59
Sulfide, Total			6	1	7	90
Metals in mg/kg						
Antimony, Total	150	200	0.02 U	0.02 U	0.02 U	0.02
Arsenic, Total	57	700	1.3	0.7	1.3	1.4
Cadmium, Total	5.1	14	0.11 J	0.09 U	0.21 J	0.21 J
Chromium, Total			9.3	9.9	18.3	21.4
Copper, Total	390	1300	13.1	12.3	25.5	48
Lead, Total	450	1200	5.6	4.64	12.7	15.2
Mercury, Total	0.41	2.3	0.02 J	0.02 U	0.05	0.07
Nickel, Total	140	370	12.7	12.6	16.2	18.3
Silver, Total	6.1	8.4	0.12	0.08	0.18	0.3
Zinc, Total	410	3800	40	38.6	58.3	73.9
Organometallics in µg/L						
Tri-n-butyltin	0.15		0.02 U	0.02	0.07	0.12
LPAHs in µg/kg						
Acenaphthene	500	2000	31000	160	20 U	20 U
Acenaphthylene	560	1300	10000 U	100 U	20 U	20 U
Anthracene	960	13000	26000	340	20 U	20 U
Fluorene	540	3600	14000	140	20 U	20 U
Naphthalene	2100	2400	10000 U	100 U	20 U	20 U
Phenanthrene	1500	21000	84000	1300	23	33
Total LPAHs	5200	29000	155000	1940	23	33
HPAHs in µg/kg						
Benz(a)anthracene	1300	5100	39000	340	20	28
Benzo(a)pyrene	1600	3600	39000	340	22	29
Benzo(b)fluoranthene			19000	180	23	34
Benzo(g,h,i)perylene	670	3200	18000	170	20 U	20 U
Benzo(k)fluoranthene			21000	190	20 U	26
Chrysene	1400	21000	42000	360	26	36
Dibenz(a,h)anthracene	230	1900	10000 U	100 U	20 U	20 U
Fluoranthene	1700	30000	110000	1200	59	85
Indeno(1,2,3-cd)pyrene	600	16000	24000	230	20 U	23
Pyrene	2600	16000	140000	1400	62	83
Total Benzofluoranthenes	3200	9900	40000	370	23	60
Total HPAHs	12000	69000	452000	4410	212	344
Phenols in µg/kg						
2,4-Dimethylphenol	29	210	3000 U	30 U	6 U	6 U
2-Methylphenol	63	77	3000 U	30 U	6 U	6 U
4-Methylphenol	670	3600	10000 U	100 U	20 U	20 U
Pentachlorophenol (PCP)	400	690	30500 U	305 U	61 U	61 U
Phenol	420	1200	10000 U	100 U	20 U	20 U
Phthalates in µg/kg						
Bis(2-ethylhexyl) Phthalate	8300		10000 U	100 U	300	430
Butyl Benzyl Phthalate	970		10000 U	100 U	20 U	67
Di-n-butyl Phthalate	5100		10000 U	100 U	20 U	20 U

Table 9 - Analytical Results for Sediment Samples; Willamette River Surface Sediment Samples

Sample ID Lab ID Sampling Date Sampling Depth Interval	LCRMA SL	LCRMA ML	Grab 5 K9806351-005 9/14/98 0 to 10 cm	Grab 6 K9806351-006 9/14/98 0 to 10 cm	Grab 7 K9806351-007 9/14/98 0 to 10 cm	Grab 8 K9806351-008 9/14/98 0 to 10 cm
Di-n-octyl Phthalate	6200		10000 U	100 U	20 U	25
Diethyl Phthalate	1200		10000 U	100 U	20 U	20 U
Dimethyl Phthalate	1400		10000 U	100 U	20 U	20 U
Semivolatiles in µg/kg						
Benzoic Acid	650	760	50000 U	500 U	100 U	100 U
Benzyl Alcohol	57	870	3000 U	30 U	6	9
Dibenzofuran	540	1700	10000 U	100 U	20 U	20 U
Hexachlorobenzene	22	230	10000 U	100 U	20 U	20 U
Hexachlorobutadiene	29	290	10000 U	100 U	20 U	20 U
N-Nitrosodiphenylamine	28	130	60000 U	60 U	12 U	12 U
Volatiles in µg/kg						
1,2-Dichlorobenzene	35	110	1 U	1 U	1 U	1 U
1,3-Dichlorobenzene	170		1 U	1 U	1 U	1 U
1,4-Dichlorobenzene	110	120	1 U	1 U	1 U	1 U
Pesticide/PCBs in µg/kg						
4,4'-DDD			14	3.3 U	3.3 U	3.3 U
4,4'-DDE			2.3 U	2.3 U	3.8	2.4
4,4'-DDT			11	6.7 U	6.7 U	6.7 U
Total DDT	6.9	69	25	6.7 U	3.8	2.4
Aldrin	10		1.7 U	1.7 U	1.7 U	1.7 U
Aroclor 1016			10 U	10 U	10 U	10 U
Aroclor 1221			10 U	10 U	10 U	10 U
Aroclor 1232			10 U	10 U	10 U	10 U
Aroclor 1242			10 U	10 U	10 U	10 U
Aroclor 1248			10 U	10 U	10 U	10 U
Aroclor 1254			10 U	10 U	10 U	10 U
Aroclor 1260			10 U	10 U	10 U	10 U
Total PCBs	130	3100	10 U	10 U	10 U	10 U
Chlordane	10					
Dieldrin	10		2.3 U	2.3 U	2.3 U	2.3 U
Endosulfan I						
Endosulfan II						
Endosulfan Sulfate						
Endrin						
Endrin Aldehyde						
Endrin Ketone						
Heptachlor	10		1.7 U	1.7 U	1.7 U	1.7 U
Heptachlor Epoxide						
Methoxychlor						
Toxaphene						
alpha-BHC						
alpha-Chlordane			1.7 U	1.7 U	1.7 U	1.7 U
beta-BHC						
delta-BHC						
gamma-BHC (Lindane)	10		1.7 U	1.7 U	1.7 U	2 U
gamma-Chlordane			1.7 U	1.7 U	1.7 U	1.7 U

Notes: Exceeds LCRMA SL

Exceeds LCRMA ML

SQLs Exceeds LCRMA SL

Table 9 - Analytical Results for Sediment Sampels; Willamette River Surface Sediment Samples

Sample ID			Grab-9	Grab-10	Grab-11	Grab-12
Lab ID			K9806410-004	K9806410-005	K9806410-006	K9806410-007
Sampling Date	LCRMA	LCRMA	9/15/98	9/15/98	9/15/98	9/15/98
Sampling Depth Interval	SL	ML	0 to 10 cm	0 to 10 cm	0 to 10 cm	0 to 10 cm
Conventionals						
Ammonia as Nitrogen			106 UJ/J	88.1 UJ/J	167 UJ/J	96.6 UJ/J
Carbon, Total Organic (TOC)			1.58	1.57	2.24	1.23
Solids, Total						
Solids, Total Volatile						
Sulfide, Total			3	3	39	4
Metals in mg/kg						
Antimony, Total	150	200	0.15 UJ/J	0.15 UJ/J	0.16 UJ/J	0.22 UJ/J
Arsenic, Total	57	700	2.4	2	2.3	2.1
Cadmium, Total	5.1	14	0.14	0.17	0.19	0.15
Chromium, Total			20.1	20.1	22.3	18.3
Copper, Total	390	1300	21.6 UJ/J	22 UJ/J	25.6 UJ/J	20.5 UJ/J
Lead, Total	450	1200	14.5	14.8	13.2	13.6
Mercury, Total	0.41	2.3	0.06	0.06	0.07	0.05
Nickel, Total	140	370	16.8	17.1	18	16.8
Silver, Total	6.1	8.4	0.22	0.23	0.29	0.22
Zinc, Total	410	3800	63.7	63.2	64.1	63.2
Organometallics in µg/L						
Tri-n-butyltin	0.15		0.02 U	0.02 U	0.02 U	0.02 U
LPAHs in µg/kg						
Acenaphthene	500	2000	20 U	20 U	20 U	20 U
Acenaphthylene	560	1300	20 U	20 U	20 U	20 U
Anthracene	960	13000	20 U	20 U	20 U	20 U
Fluorene	540	3600	20 U	20 U	20 U	20 U
Naphthalene	2100	2400	20 U	20 U	20 U	20 U
Phenanthrene	1500	21000	26	20	48	25
Total LPAHs	5200	29000	26	20	48	25
HPAHs in µg/kg						
Benz(a)anthracene	1300	5100	26	27	28	25
Benzo(a)pyrene	1600	3600	28	36	22	28
Benzo(b)fluoranthene			29	32	24	27
Benzo(g,h,i)perylene	670	3200	20 U	22	20 U	20 U
Benzo(k)fluoranthene			21	24	20 U	20
Chrysene	1400	21000	31	32	27	31
Dibenz(a,h)anthracene	230	1900	20 U	20 U	20 U	20 U
Fluoranthene	1700	30000	67	59	85	65
Indeno(1,2,3-cd)pyrene	600	16000	23	29	20 U	23
Pyrene	2600	16000	68	62	75	72
Total Benzofluoranthenes	3200	9900	50	56	24	47
Total HPAHs	12000	69000	293	323	261	291
Phenols in µg/kg						
2,4-Dimethylphenol	29	210	6 U	6 U	6 U	6 U
2-Methylphenol	63	77	6 U	6 U	6 U	6 U
4-Methylphenol	670	3600	20 U	20 U	20 U	20 U
Pentachlorophenol (PCP)	400	690	61 U	61 U	61 U	61 U
Phenol	420	1200	20 U	20 U	20 U	20 U
Phthalates in µg/kg						
Bis(2-ethylhexyl) Phthalate	8300		410	320	440	1000
Butyl Benzyl Phthalate	970		38	48	22	33
Di-n-butyl Phthalate	5100		20 U	20 U	20 U	20 U

Table 9 - Analytical Results for Sediment Sampels; Willamette River Surface Sediment Samples

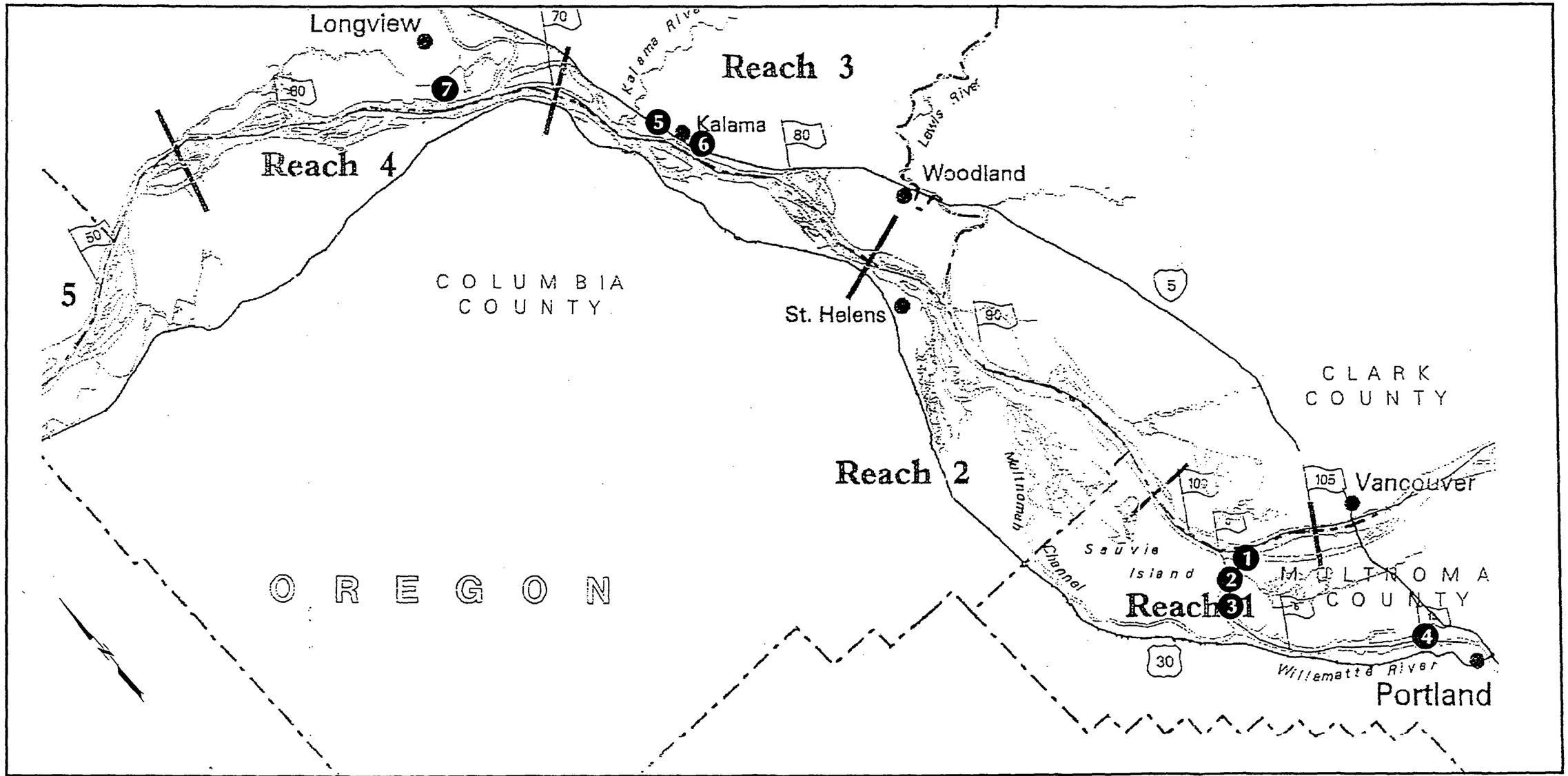
Sample ID Lab ID Sampling Date Sampling Depth Interval	LCRMA SL	LCRMA ML	Grab-9 K9806410-004 9/15/98 0 to 10 cm	Grab-10 K9806410-005 9/15/98 0 to 10 cm	Grab-11 K9806410-006 9/15/98 0 to 10 cm	Grab-12 K9806410-007 9/15/98 0 to 10 cm
Di-n-octyl Phthalate	6200		20 U	20 U	20 U	20 U
Diethyl Phthalate	1200		20 U	20 U	20 U	20 U
Dimethyl Phthalate	1400		20 U	20 U	20 U	20 U
Semivolatiles in µg/kg						
Benzoic Acid	650	760	100 U	100 U	100 U	100 U
Benzyl Alcohol	57	870	6 U	8	6 U	9
Dibenzofuran	540	1700	20 U	20 U	20 U	20 U
Hexachlorobenzene	22	230	20 U	20 U	20 U	20 U
Hexachlorobutadiene	29	290	20 U	20 U	20 U	20 U
N-Nitrosodiphenylamine	28	130	12 U	12 U	12 U	12 U
Volatiles in µg/kg						
1,2-Dichlorobenzene	35	110	1 U	1 U	1 U	1 U
1,3-Dichlorobenzene	170		1 U	1 U	1 U	1 U
1,4-Dichlorobenzene	110	120	1 U	1 U	1 U	1 U
Pesticide/PCBs in µg/kg						
4,4'-DDD			2 U	2 U	2 U	2 U
4,4'-DDE			2 U	2 U	3	2 U
4,4'-DDT			2 U	2 U	2 U	2 U
Total DDT	6.9	69	2 U	2 U	3	2 U
Aldrin	10		2 U	2 U	2 U	2 U
Aroclor 1016			10 U	10 U	10 U	10 U
Aroclor 1221			10 U	10 U	10 U	10 U
Aroclor 1232			10 U	10 U	10 U	10 U
Aroclor 1242			10 U	10 U	10 U	10 U
Aroclor 1248			10 U	10 U	10 U	10 U
Aroclor 1254			10 U	10 U	10 U	10 U
Aroclor 1260			10 U	14	10 U	14
Total PCBs	130	3100	10 U	14	10 U	14
Chlordane	10					
Dieldrin	10		2 U	2 U	2 U	2 U
Endosulfan I			2 U	2 U	2 U	2 U
Endosulfan II			2 U	2 U	2 U	2 U
Endosulfan Sulfate			2 U	2 U	2 U	2 U
Endrin			2 U	2 U	2 U	2 U
Endrin Aldehyde			2 U	2 U	2 U	2 U
Endrin Ketone			2 U	2 U	2 U	2 U
Heptachlor	10		2 U	2 U	2 U	2 U
Heptachlor Epoxide			2 U	2 U	2 U	2 U
Methoxychlor			4 U	4 U	4 U	4 U
Toxaphene			40 U	60 U	70 U	70 U
alpha-BHC			2 U	2 U	2 U	2 U
alpha-Chlordane			2 U	2 U	2 U	2 U
beta-BHC			2 U	2 U	2 U	2 U
delta-BHC			2 U	2 U	2 U	2 U
gamma-BHC (Lindane)	10		2 U	2 U	2 U	2 U
gamma-Chlordane			2 U	2 U	2 U	2 U

Notes: Exceeds LCRMA SL

SQLs Exceeds LCRMA SL

General Location of Sampling Areas

Columbia River Navigation Channel



Note: Base map prepared from "Columbia River Dredged Material Management Study Overview Map".

Study Sites:

	Site	Port Facility	River
1	Terminal 6	Port of Portland	Columbia
2	Berth 301	Port of Portland	Willamette
3	Berth 401	Port of Portland	Willamette
4	Irving Street Terminal	Port of Portland	Willamette
5	Peavey Grain Terminal	Port of Kalama	Willamette
6	Harvest States Grain Terminal	Port of Kalama	
7	Longview Grain Wharf	Port of Longview	Columbia

4 0 4 8

SCALE IN MILES

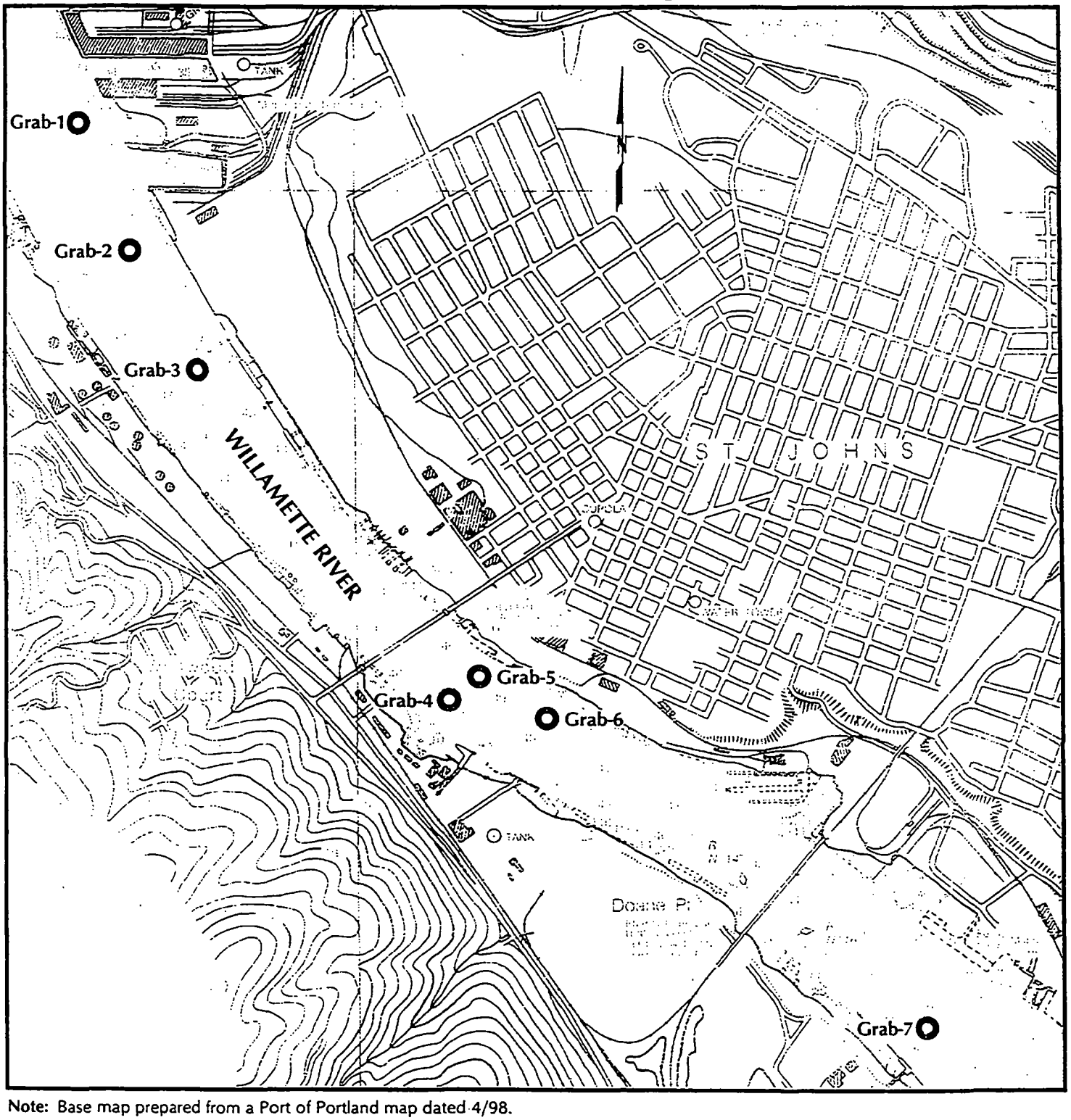
HARTCROWSER

J-5760 8/98

Figure 1

General Location of Sampling Areas

Surface Sediments, Willamette River, Portland, Oregon



Note: Base map prepared from a Port of Portland map dated 4/98.

Half Nautical Mile

0 ½

Half Statute Mile

0 ½

Yards

100 0 100 200 300 400 500

Legend:

Grab-3 ○ Approximate Grab Sample Location and Designation

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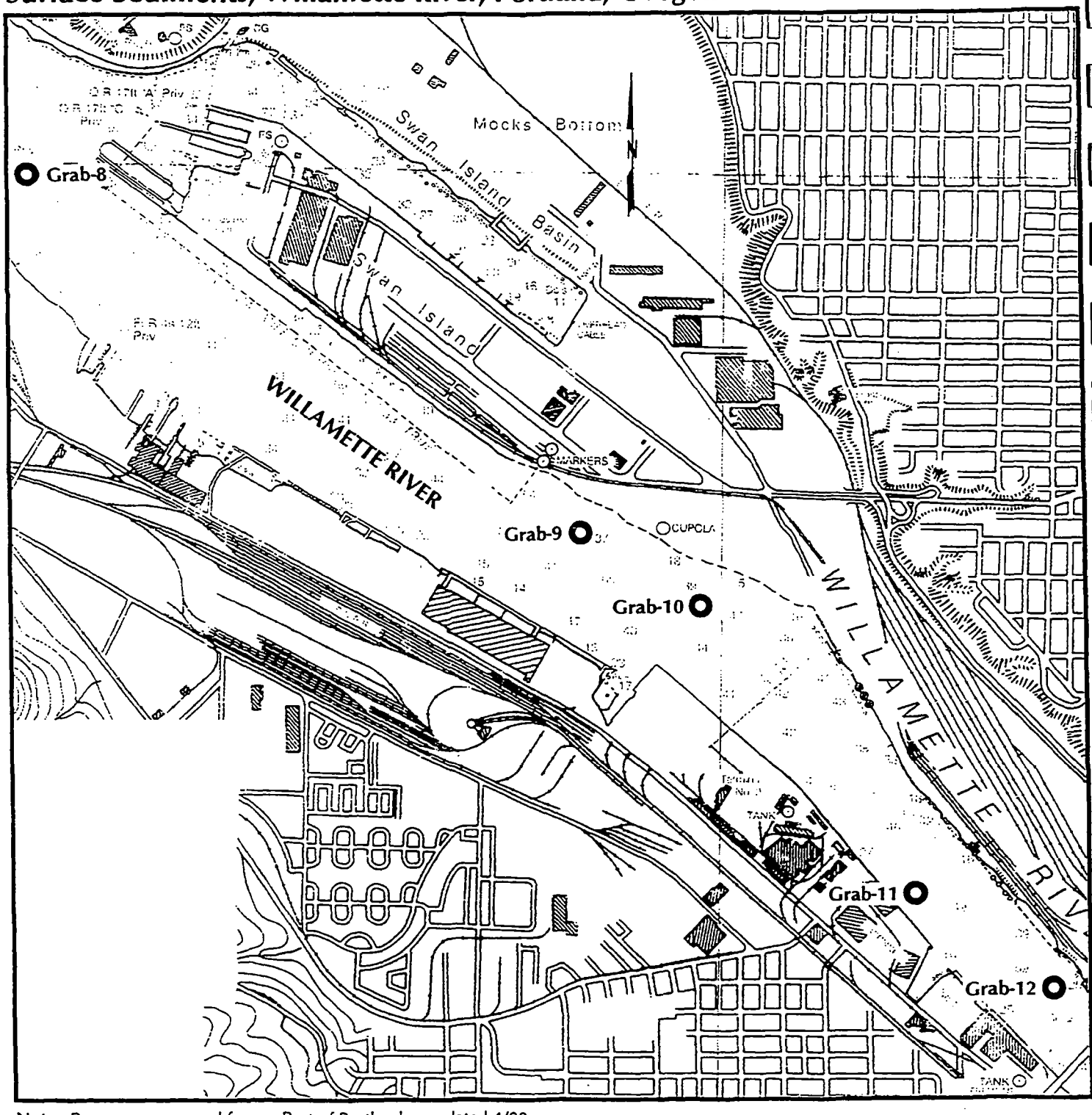
J-5760 12/98

Figure 2

General Location of Sampling Areas

Surface Sediments, Willamette River, Portland, Oregon



Note: Base map prepared from a Port of Portland map dated 4/98.

Half Nautical Mile
0 ½

Half Statute Mile
0 ½

Yards
100 0 100 200 300 400 500

Legend:

Grab-8 ● Approximate Grab Sample Location and Designation

HARTCROWSER
J-5760 12/98
Figure 3

APPENDIX A
CHEMICAL DATA QUALITY REVIEW

APPENDIX A
CHEMICAL DATA QUALITY REVIEW

In total, 34 sediment samples, including two field duplicates, were collected between September 14, 1998 and September 17, 1998. The samples were submitted to Columbia Analytical Services, Kelso, Washington for analysis of the following:

- Total Metals (EPA Method 200.8/7471A);
- Semivolatile Organics (GC/MS SIM);
- Volatile Organics (EPA Method 8260B);
- Pesticides/PCBs (EPA Method 8081/8082);
- Tributyltin (TBT, GC/FPD);
- Total Organic Carbon (ASTM D4129-82M);
- Ammonia (EPA Method 350.1M);
- Sulfide (PSEP);
- Total Volatile Solids (EPA Method 160.4M); and
- Total Solids (EPA Method 160.3).

The following criteria were evaluated in the standard data quality review process for the results:

- Holding times;
- Method blanks;
- Reporting Limits;
- Surrogate recoveries;
- Blank spike and laboratory control sample (LCS) recoveries;
- Matrix spike/matrix spike duplicate (MS/MSD) recoveries; and
- Laboratory duplicates relative percent differences (RPDs).

Total Metals. All required holding times were met. Chromium, lead, nickel, silver, and zinc were detected below detection limits in method blanks. No qualifiers were assigned since sample concentrations were greater than five times blank contaminations. Cadmium was detected above detection limit in one method blank. Sample GRAB 6 was qualified as not detected (U). Reporting limits were elevated due to sample dilution. LCS recoveries were within laboratory control limits. The MS recoveries of antimony and copper were below laboratory control limits. Associated sample results were qualified as estimated (UJ/J). Laboratory duplicate RPDs were acceptable.

Semivolatile Organics. All required holding times were met. No method blank contamination was detected. Reporting limits were elevated due to sample

dilution. Surrogate recoveries of 2-fluorophenol and 2,4,6-tribromophenol in the acid fraction were below laboratory control limits in method blanks, QC samples, and several project samples. Samples were reextracted and reanalyzed outside holding time by 42 to 45 days. Since reextraction grossly exceeded holding time criteria and demonstrated surrogates outside control limits were due to matrix interference, initial sample results were used. LCS and MS/MSD recoveries were within laboratory control limits.

Volatile Organics. All required holding times were met. No method blank contamination was detected. Reporting limits were elevated due to low percent solids in samples. Surrogate, LCS, and MS/MSD recoveries were within laboratory control limits.

Pesticides/PCBs. All required holding times were met. No method blank contamination was detected. Reporting limits were elevated due to matrix interference. Surrogate, LCS, and MS/MSD recoveries were within laboratory control limits.

Tributyltin. All required holding times were met. No method blank contamination was detected. Reporting limits were elevated due to insufficient sample provided for analysis. Surrogate recoveries of tri-n-propyltin were below laboratory control limits in method blank, QC sample, and several project samples. Samples HS-01-C1, PG-01-C1, and LG-01-C1 were qualified as estimated (UJ/J). LCS recoveries were acceptable. MS/MSD recoveries were below laboratory control limits due to severe emulsions during extraction. No qualifiers were assigned since LCS recoveries were acceptable.

Total Organic Carbon. All required holding times were met. No method blank contamination was detected. LCS and MS recoveries were acceptable. Laboratory duplicate RPD was within control limits.

Ammonia/Sulfide. All required holding times were met. No method blank contamination was detected. LCS and MS recoveries were within control limits. Laboratory duplicate RPD for ammonia was above laboratory control limits. Associated sample results in accession K9806410 were qualified as estimated (UJ/J).

Total Volatile Solids/Total Solids. All required holding times were met. No method blank contamination was detected. Laboratory duplicate RPDs were within control limits.